THE ROLE OF POSITIVE INCENTIVES IN FOSTERING INTERNATIONAL ENVIRONMENTAL COOPERATION

THE NUCLEAR SAFETY PROBLEM IN CENTRAL AND EASTERN EUROPE AND THE FORMER SOVIET UNION

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PREFACE

Is it possible to facilitate international cooperation through positive incentives, and if so, what are the advantages, the drawbacks, and the risks of such a strategy for the providers and recipients of positive incentives? This was the principal research question of a project carried out between 1996 and 1998 by six political scientists and led by Thomas Bernauer from the Swiss Federal Institute of Technology (ETH) Zurich and Dieter Ruloff from the University of Zurich.[1] While the theoretical propositions developed in this project were evaluated on the basis of case studies in the field of arms control and non-proliferation, the authors suggested that the analytical framework developed in the project could generate useful insights into the role of positive incentives in fostering international cooperation in issue-areas beyond arms control, such as international trade policy or international environmental politics.

Participating in the aforementioned project as a research assistant and co-author of one empirical chapter had definitively cemented my interest in the politics of positive incentives. I therefore did not hesitate long to follow the suggestion of the authors to analyze the role of positive incentives in the field of international environmental politics. In doing so, I focused on the international efforts to solve one specific transnational environmental problem: The nuclear safety threat posed by the continued operation of unsafe nuclear reactors in the countries of Central and Eastern Europe (CEE) and the Former Soviet Union (FSU). This subject has not only proven to be a useful testing ground to evaluate the theoretical propositions developed in this book, but was in itself a fascinating and challenging research topic.

Various individuals have made this study possible. First and foremost I am indebted to my longstanding teacher in International Relations, Thomas Bernauer, Professor at the Center for International Studies (CIS) of the Swiss Federal Institute of Technology Zurich, who has guided my research effort from the beginning and never got tired of providing me with valuable advice and assistance on tricky theoretical and methodological issues. Next, I would like to thank the following individuals for providing me with information or helping me gain access to important information sources for the empirical analysis. To begin with, I would like to thank Lars Larsson, former Director of the Nuclear Safety Account (NSA), who granted me two long interviews in London in March 1998 and March 2000, and Günther Grabia

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[1] The findings of this research effort were published in: Bernauer, Thomas, and Dieter Ruloff, eds. (1999). *The Politics of Positive Incentives in Arms Controls*. Columbia: University of South Carolina Press.

(operation leader for the Ignalina and Leningrad projects), Didier Rousseau (operation leader for the Chernobyl, Kola and Novovoronezh projects) and Max Schnellmann (Principal Manager of the EBRD's Nuclear Safety Unit), for their help in clarifying various issues pertaining to the nuclear safety projects of the NSA. I would also like to thank Antony Frogatt, independent energy consultant and author of various reports on nuclear energy issues in Eastern Europe, who provided me with invaluable information and advice.

I am also greatly indebted to Ann MacLachlan, head of the European office of Nucleonics Week in Paris, who constantly kept me up to date on recent developments in the field. Furthermore, I would like to thank Tim Gabruch and Charu Jasani, Research Officers at the London-based Uranium Institute, who were very helpful in providing me with information not easily accessible in Switzerland and Peter Hählen, General Secretary of the Swiss Association for Atomic Energy, who granted me free access to the on-line databank 'NucNet'. I am also grateful to Dr. Frank Marty and Dr. Peter Moser for their helpful comments on an earlier draft of this study, and to Raphaël Tschanz for his essential 'IT' support in finalizing the last draft of this study. Finally I would like to thank my wife Judith who never got tired of encouraging and supporting me.

ABBREVIATIONS AND ACRONYMS

CEE	Central and Eastern Europe
EBRD	European Bank for Reconstruction and Development
ECU	European Currency Unit (approximate conversion rate: 1 ECU = $1.2). On 1 January 1999 the Euro replaced the ECU with a conversion rate of 1:1.
EIB	European Investment Bank
EdF	Electricité de France
EU	European Union
FSU	Former Soviet Union
G-7	Group of Seven Industrialized Countries (Canada, France, Germany, Italy, Japan, United Kingdom, and United States)
G-24	Group of 24 (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Island, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States)
GRS	Gesellschaft für Anlagen- und Reaktorsicherheit
GWh	Gigawatt hour
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IFI	International Financial Institution
IMF	International Monetary Fund
IPSN	Institut de Protéction et Sécurité Nucléaire
KWh	Kilowatt hour
MW	Megawatt
NPP	Nuclear Power Plant
NSA	Nuclear Safety Account
NUSAC	Nuclear Safety Assistance Coordination Center
OECD	Organization for Economic Cooperation and Development
PHARE	Poland-Hungary Assistance for Reconstruction of the Economy
PMU	Project Management Unit
RBMK	Graphite moderated channel reactor
TACIS	Technical Assistance to the Commonwealth of Independent States
TWh	Terawatt hour
VVER	Pressurized water reactor (PWR)

1 INTRODUCTION

In the wake of the revolutions that transformed the political landscape of Central and Eastern Europe (CEE) and the Former Soviet Union (FSU) in 1989-1991, the West was abruptly confronted with a severe nuclear safety threat emanating from the former socialist Eastern bloc: The continued operation of unsafe Soviet-designed civilian nuclear reactors. In 1990/1991 Western nuclear safety experts had for the first time gained unrestricted access to Soviet-built nuclear power plants that had so far been carefully shielded from foreign scrutiny. These experts had concluded that the continued operation of a large number of the total 58 operational nuclear reactors in CEE and the FSU posed unacceptable safety risks and that a serious accident could occur unless urgent action was undertaking. Their conclusions sparked widespread fears in the West that a repetition of the 1986 Chernobyl tragedy was imminent: The meltdown and subsequent explosion of the fourth unit of the Chernobyl Nuclear Power Plant (NPP) on 26 April 1986 had not only seriously contaminated vast tracts of land in the then existing Soviet Union, but had also exposed the populations of various Western European countries to sharply elevated levels of radiation, caused considerable economic damage and had dealt a serious blow to the political viability of nuclear power in the West.

Faced with the alarming prospect of yet another Chernobyl-style nuclear catastrophe, Western states called on the countries of CEE and the FSU to close their most dangerous Soviet-designed nuclear reactors as soon as possible. However, these countries argued that they could not afford to comply with such closure demands: They did not only heavily depend on the power generated at these units, but were deeply concerned about the economic and social costs of closure. This unappealing situation prompted various Western countries and organizations into offering significant amounts of nuclear safety and other assistance in exchange for commitments on the part of various CEE and FSU governments to prematurely close unsafe Soviet-designed nuclear reactors. What subsequently followed in the field of international nuclear safety cooperation amounted not only to one of the most extensive, but also to one of the most contentious transfers of conditional environmental assistance in the history of international environmental politics.

Without going so far as to claim that the story of Western nuclear safety assistance to the countries of CEE and the FSU represents a paradigmatic case in international environmental politics, it is beyond doubt that it captures important aspects of both the most

pressing transnational environmental problems and the likely response to them. To begin with, the safety threat posed by the continued operation of unsafe Soviet-designed nuclear reactors constituted a transnational environmental problem, or in abstract terms, a negative externality: The safety threat did not only affect the specific country from which it emanated, but also many third countries. As such the nuclear safety threat posed by the continued operation of unsafe Soviet-designed nuclear reactors was a matter of international concern. Second, the nuclear safety problem in CEE and the FSU was characterized by asymmetric preferences and capacities: Whereas the relatively affluent Western countries were strongly interested in high levels of nuclear safety and disposed over the financial and technical means to secure this objective, the less well-off countries operating unsafe Soviet-designed nuclear reactors lacked both the immediate incentives and the capacities to secure high levels of nuclear safety, in particular if this meant prematurely closing their unsafe nuclear reactors. Thus the underlying structure of the nuclear safety problem in CEE and the FSU—i.e. asymmetric preferences and capacities—impeded domestic efforts to reduce or eliminate the risk of a nuclear accident and necessitated international cooperation. In this respect the nuclear safety problem resembles other transnational environmental problems whose solution depends to varying degrees on the active participation of the capacity-poor countries of the developing world or of the so-called countries in transition. Finally, the specific cooperation strategy by which the concerned Western states and organizations predominantly sought to induce and enable the countries of CEE and the FSU to cooperate in the nuclear safety field—the provision of positive incentives—is a policy tool which in the past years has been increasingly employed to promote international environmental cooperation, in particular in North-South and East-West environmental politics.

For the reasons outlined above, the various transactions that materialized in the field of international nuclear safety cooperation provide rich empirical material against which the principal research question of this study can be evaluated: *When and how can positive incentives foster international cooperation so as to solve transnational environmental problems in effective and efficient ways and what are the problems that typically arise when bringing positive incentives to bear*. This research question is relevant both for practical and theoretical reasons. As noted above, various concerned countries have in the past years increasingly resorted to cooperation strategies involving positive incentives, in particular in those cases in which the active participation of capacity-poor countries is critical for the success of any cooperative endeavor. Moreover, with a view to the fact that the amount of

available resources to combat transboundary environmental degradation is often seriously limited, concerned governments and organizations contemplating the use of positive incentives in international environmental affairs have an evident interest in using their resources as efficiently as possible. As such there are practical reasons to acquire a better understanding of the advantages and drawbacks of positive incentives. On the other hand, the theoretical literature in International Relations has with some rare exceptions not yet systematically analyzed the role of positive incentives in fostering international environmental cooperation. Although various theories posit that positive incentives can be useful in facilitating international cooperation, we lack systematic knowledge on the conditions under which positive incentives are effective and efficient and on the problems that arise when employing positive incentives.

Aspiring to enhance our practical and theoretical knowledge of positive incentives, I draw and expand on existing theoretical insights into the role of this policy tool and develop an analytical framework designed to explain and evaluate the effectiveness and efficiency of positive incentives. The outcomes to be explained in this study are the effectiveness and efficiency of positive incentives. *Positive incentives* are conceptualized as transactions, i.e. as transfers of positively valued resources, such as money, technology and know-how, from one actor to another with the aim of driving the behavior of the recipient in a direction that is desirable from the point of view of the provider. The *effectiveness* of a transaction denotes the extent to which the provision of positive incentives drove the behavior of the recipient state in a direction desired by the provider state. The *efficiency* of a transaction refers to the cost-effectiveness of positive incentives. In evaluating the efficiency of a transaction I basically seek to determine whether the providers of positive incentives paid too much for what they gained in terms of environmental benefits resulting from the behavioral changes on the part of the recipient. The concept of efficiency used in this study encompasses two related, nevertheless distinct dimensions. The *first dimension of efficiency* relates to the question of whether the employment of cooperation strategies other than positive incentives—i.e. positive issue-linkage, negative incentive, cognitive and normative strategies—could have led to comparable or superior externality-reducing behavioral changes on the part of the recipient country at a lower or comparable cost. The *second dimension of efficiency* relates to the question of whether alternative ways of employing positive incentives—i.e. the funding and implementation of other capacity-building measures—could have resulted in comparable or superior externality-reducing behavioral changes on the part of the recipient country at a

lower or comparable cost. The *explanatory concepts* of the analytical framework are operationalized in terms of problems that arise when designing and implementing positive incentives and that may have an impact on the effectiveness and/or efficiency of a transaction. These problems, which are derived from game theory, negotiation analysis, economic theories and International Relations theory in general and build upon the results of empirical research on incentives in various areas of international relations, are summarized below.

Extortion: A recipient state may seek to extract payments from provider states by bluffing the latter into believing that it would generate or increase a negative externality if not rewarded for refraining from doing so. Since the recipient would not have delivered on its threat regardless of whether its payment demand was met, extortion may mislead provider states into paying too much for what they receive in terms of environmental benefits. In addition, extortion may deter provider states from engaging in mutually beneficial transactions. Problems of extortion can thus negatively affect the efficiency (first dimension) and/or effectiveness of a transaction.

Moral Hazard: The prospect of external aid may induce a potential recipient state to engage in overly risky behavior because it expects that other countries will provide the necessary resources to reduce the harmful effects of its risky behavior to an acceptable level. Moral hazard behavior may mislead the provider states into paying too much for what they receive in terms of environmental benefits: If the recipient state had not been certain that it would receive aid, it would have been less willing to engage in risky activities. In addition, moral hazard behavior can discourage provider states from engaging in transactions. Moral hazard problems can thus impinge on the efficiency (first dimension) and/or effectiveness of a transaction.

Information and distribution problems: These two problems are closely related. Information problems derive from the fact that provider and recipient states have incomplete information about the other's future preferences and behavior. Distribution problems arise because the provider and the recipient states have an incentive to enhance their net-benefits by manipulating information on the costs and benefits of cooperation. Such behavior may lead to protracted negotiations and even to their failure. Moreover, negotiations may falter simply due to the fact that provider and recipient states have incomplete information on the exact value of the object under negotiation. Information and distribution problems can negatively affect the effectiveness of a transaction.

Enforcement problems: The successful implementation of environmental assistance programs may be negatively affected by enforcement problems. Provider states may lack the means to enforce international environmental agreements, or they may be reluctant to do so for normative or practical reasons, or because such action often inflicts considerable economic and political costs on the enforcing states as well. Hence enforcement problems can impinge on the effectiveness of a transaction.

Problem-Definition: This problem is based on the assumption that not all capacity-building measures selected for funding and implementation by the provider states are equally cost-effective. Which capacity-building measures donors chose to fund and implement is determined by what is referred to here as problem-definition, i.e. the specific way donors define an environmental problem. The specific problem-definition donors adopt is strongly determined by the specific interests of donor governments and

domestic interest groups. In short, problem-definition may have negative implications for the efficiency (second dimension) of a transaction.

"Slippery slope effect": This problem captures the risk that resources transfers aimed at enabling a recipient state to renounce an undesirable behavior and adopt a new desirable behavior may unintentionally induce and/or enable the recipient state to continue its previous undesirable behavior, albeit at marginally less detrimental levels. For example, a recipient may be reluctant or incapable to immediately close an outdated facility whose emissions have harmful effects on other countries. Donors may thus offer to modernize the facility in exchange for a commitment on the part of the recipient to definitely close the facility in the near future. However, once the facility has been modernized, the recipient may have even less incentive to definitely close it than before. The "slippery slope effect" can thus hamper the effectiveness of a transaction.

Coordination problems among provider states: Such problems typically arise when there is more than one donor and tend to vary according to the specific nature of the benefits the donors expect to gain from addressing a transnational environmental problem. In the case of public benefits, the donors may have to cope with disputes over which donor should provide which amount of resources and why. Such burden-sharing problems may lead to a sub-optimal provision of resources. If the benefits to be gained are predominantly private, then a competition for these private benefits may break out in the donor group. Such competition may frustrate any attempt to establish a united donor front and hence allow the recipient to circumvent the conditions donors may seek to impose on their aid programs. Coordination problems can thus negatively affect the effectiveness of a transaction.

The theoretical propositions of the analytical framework boil down to the following *basic hypothesis*: The more the designated problems crop up in a transaction both in terms of their occurrence and intensity, or conversely, the less successful the provider states are in coping with these problems, the lower the effectiveness and/or efficiency of the transaction. That said, it must be emphasized that the basic analytical framework is not so much designed to allow for rigorous hypothesis testing but rather aims to provide a checklist of problems that typically arise when employing positive incentives. Indeed, instead of attempting to precisely measure the influence of each problem on the effectiveness and/or efficiency of a transaction, I aim to identify the problems that may arise in a transaction and evaluate and explain whether and how they individually or collectively affected the outcomes to be explained in empirical cases.

Methodology and Case Studies

In empirically evaluating the theoretical propositions developed in the analytical framework, I adhere to a research strategy that focuses on *qualitative case studies*. A qualitative case study approach is useful when few cases exist, the perspective is dynamic, a quantification of the

major variables of interest is difficult, and the aim is to cast the analytical net deep rather than wide. Indeed, a qualitative case study approach allows us to look for evidence about whether a particular explanatory variable influenced the dependent variable via a hypothesized causal pathway (Mitchell and Bernauer 1998: 7). In this study a *"case"* is conceptualized as a transaction, i.e. the process of providing positive incentives in exchange for behavioral changes on the part of the recipient. Each case study involves the analysis of a transaction over time and concludes with an assessment that is structured along the following lines. I first explore the extent to which the recipient country changed its behavior in a direction desired by the provider countries. Second, I describe the various cooperation strategies and capacity-building measures employed by the provider countries to influence the behavior of the recipient. In a third step I determine the extent to which the observed behavioral change on the part of the recipient country was influenced by the provision of positive incentives and evaluate the effectiveness of the transaction. In a fourth step I provide an assessment of the efficiency of the transaction by evaluating whether the provider countries could have secured larger net-benefits by resorting to a cooperation strategy other than positive incentives or by employing positive incentives in different ways, i.e. funding alternative capacity-building measures. Finally, I assess the extent to which the theoretically predicted problems in designing and implementing positive incentives shaped the effectiveness and efficiency of the transaction.

In analyzing each transaction I adhere to the *"process tracing"* method. This research method is used to unpack the sequence of events that make up the bargaining and implementation process and to trace the connections between the individual events that constitute the complex story of cause and effect (Victor et al. 1998). In addition, it should be noted that the efficiency of transactions is evaluated by means of *counterfactual analysis.* Counterfactuals are descriptions of what would have happened under different conditions. Although such thought experiments do not add any empirical information, they aid in describing how a particular factor has had an influence on the outcome to be explained and help clarify the causal pathway suggested by the author's analysis (Fearon 1991; Tetlock and Belkin 1996). As far as the data for the empirical analysis is concerned, they have been largely derived from published sources such as professional journals in the field of nuclear energy, daily newspapers and periodicals, and reports and fact sheets by international organizations such as the European Union (EU), the European Bank for Reconstruction and Development (EBRD) and the World Bank. The published sources have been complemented

and crosschecked by information gained from personal interviews with officials at the Nuclear Safety Account (NSA) and experts of nuclear safety developments in CEE and the FSU.

The propositions of the analytical framework are investigated by means of case studies derived from one specific issue-area of international environmental politics: The nuclear safety problem in Central and Eastern Europe (CEE) and the Former Soviet Union (FSU). This issue-area has been selected for empirical analysis because the international effort to reduce and eliminate the risk of an accident at a nuclear power plant in CEE and the FSU involved several explicit transactions between Western provider and Eastern recipient countries, thereby providing rich empirical material for case studies on the potential and problems of positive incentives. Moreover, I have chosen to limit the empirical analysis to only one issue-area in order to hold constant as far as possible certain exogenous variables, such as the characteristics of the recipient countries involved in the transactions as well as the specific situation structure underlying and the nature of the transnational environmental problem at hand. Indeed, all the recipient countries are located in the same geographical region and were coping—although admittedly to different degrees—with similar challenges arising from the transformation process towards democratic institutions and free-market economies. Furthermore, the nuclear safety problem in all recipient countries was strongly determined by asymmetric preferences and capacities and could be addressed by similar means. In short, my choice to focus on only one issue-area of international environmental politics has both advantages and drawbacks. On the one hand, it enhances the internal validity of the causal inferences drawn from the case studies conducted in this study and allows for more robust comparisons across the examined cases. On the other hand, it restricts to a certain degree the possibility of generalizing the findings of this study to other issue-areas of international environmental politics.

The research design of this study necessitates that the specific case studies derived from the nuclear safety problem in CEE and the FSU involve the analysis of transactions in which the donor states provided or attempted to provide positively valued resources in exchange for risk-reducing and risk-eliminating behavioral changes on the part of the recipient countries. In other words, my case selection relates to those nuclear safety assistance programs that included a significant degree of conditionality. Within the overall international effort to improve nuclear safety in CEE and the FSU, I have identified seven distinct transactions involving the provision of positively valued resources in exchange for risk-

reducing and risk-eliminating behavioral changes. The seven selected transactions reveal considerable variation on both the dependent and independent variables. Indeed, both the effectiveness and efficiency of positive incentives differ in the selected transactions, and these differing degrees of effectiveness and efficiency can be attributed to a host of theoretically predicted problems which vary both in their occurrence and intensity in and among the selected transactions. In the following I briefly summarize the seven selected transactions and their outcomes.

Case Study I: In June 1993, the Nuclear Safety Account (NSA) concluded a grant agreement with the Bulgarian government. The NSA agreed to provide ECU 24 million for near-term safety upgrades at the four older units of the Kozloduy Nuclear Power Plant (NPP) and International Financial Institutions (IFIs) promised to allocate an unspecified amount of favorable loans for various energy projects in exchange for the commitment on the part of the Bulgarian government to prematurely close Kozloduy units 1-4 by 1997/1998. In early 1998 the Bulgarian government refused to comply with its closure commitments on the grounds that international funding for the rehabilitation of the country's energy sector had not sufficiently materialized and announced plans to further upgrade Kozloduy units 1-4 for long-term operation. With a view to the fact that the provision of positive incentives reduced to a certain extent the risk of a nuclear accident at the Kozloduy NPP, but failed to secure the early closure of the plant's four oldest units, the effectiveness of the transaction was rather low. The transaction was efficient in the sense that the employment of no other cooperation strategy could have secured a more favorable outcome (first dimension of efficiency). However, the transaction did involve serious inefficiencies in the sense that the Western donors could have secured superior behavioral changes on the part of Bulgaria at a comparable cost by employing positive incentives in a different way (second dimension of efficiency).

Case Study II: In February 1994, the NSA concluded a grant agreement with the Lithuanian government. The NSA agreed to allocate around ECU 40 million for near-term safety upgrades at the Ignalina NPP and IFIs promised to provide an unspecified amount of low-interest loans for the rehabilitation of Lithuania's power sector in exchange for the commitment on the part of the Lithuanian government to comply with certain measures aimed at securing the early closure of the Ignalina NPP. By early 1998 it had become apparent that the Lithuanian government was keen on keeping the Ignalina NPP in operation as long as possible. The effectiveness of the transaction was rather low: While the provision of positive incentives did enhance safety levels at the Ignalina NPP, the Lithuanian government was

evidently bent of eschewing its NSA commitments and taking measures to prolong the service lives of Ignalina units 1-2. The efficiency of the transaction was high in the sense that the employment of no other cooperation could have led to a comparable or superior behavioral change on the part of Lithuania at a lower or comparable cost (first dimension of efficiency). However, the transaction did involve serious inefficiencies because it cannot be ruled out that the Western donors could have secured a more favorable outcome by employing positive incentives in a different way (second dimension of efficiency).

Case Study III: Throughout 1994 and 1995, the European Bank for Reconstruction and Development (EBRD) sought to conclude a deal with the Slovak government according to which the Slovak Republic would receive a substantial amount of low-interest loans for the completion and upgrading of two modern, partly built nuclear reactors at the Mochovce NPP in exchange for the commitment to prematurely close two unsafe units at the Bohunice NPP by the year 2000 or once the two Mochovce units were completed. The EBRD continued to press for this deal despite widespread allegations that funding the construction of a gas-fired power plant would be more cost-effective than financing the Mochovce completion project. After drawn out negotiations, the Slovak government rejected the EBRD's closure deal in late 1995. The effectiveness of the attempted transaction was low: The EBRD failed to extract a firm closure commitment from the Slovak government by offering positive incentives. As such the attempted transaction was ineffective in driving the behavior of the recipient country in a direction desired by the donors. Whereas the transaction was efficient in the sense that the Western donors could not have enhanced their net-benefits by employing another cooperation strategy (first dimension of efficiency), the transaction did involve potentially serious inefficiencies because it is not impossible that the Western donors could have secured a more favorable result by employing positive incentives in a different way (second dimension of efficiency).

Case Study IV: Since it had become evident by 1998 that the Slovak Republic, Lithuania and Bulgaria were planning to abandon previous closure commitments and to prolong the service lives of their high-risk nuclear reactors, the European Commission intervened into the ongoing closure dispute to secure the earliest possible closure of these nuclear reactors. From late 1998 on, the Commission sought to extract "realistic" closure commitments from the three Eastern European applicant countries by employing a negative incentive strategy, i.e. it linked the respective countries' prospects to begin EU membership negotiations to a cooperative stance on the closure issue. After the three applicant countries

had realized that the Commission's issue-linkage was credible, they sought to make the establishment of closure deadlines conditional on the provision of sufficient compensation. After months of haggling over the exact closure deadlines and the amount of compensation, the Commission succeeded in extracting "realistic" closure commitments from all three countries in late 1999 by offering each country a substantial amount of positive incentives in the form of decommissioning aid. The Slovak Republic promised to close Bohunice units 1-2 in 2006 and 2008. Lithuania agreed to close Ignalina unit 1 by 2005 and to decide on a definitive closure date for unit 2 in 2004. Finally, Bulgaria pledged to shut down Kozloduy units 1-2 in 2003 and to fix a definitive closure date for Kozloduy units 3-4 in 2002. It is expected that Kozloduy units 3-4 will be closed in 2006-2008/10. Whereas Lithuania's closure commitments were fully in line with the Commission's original closure demands, the closure schedules conceded by the Slovak Republic and Bulgaria were somewhat delayed compared to what the Commission had originally demanded.

The effectiveness of these three transactions varied slightly: Whereas the effectiveness of the transaction between the Commission and Lithuania was high, the effectiveness of the other two transactions in which the Commission sought to extract "realistic" closure commitments from the Slovak Republic and Bulgaria was rather high. This assessment is based on the following considerations. Although the Commission's negative issue-linkage strategy was no doubt instrumental in securing these closure schedules, it is doubtful whether this cooperation strategy alone would have been successful. Hence the provision of positive incentives was most likely a necessary means to secure "realistic" closure commitments. On the other hand, the specific closure schedules conceded by the Slovak Republic and Bulgaria—in contrast to those conceded by Lithuania—were not fully in line with the Commission's original closure demands. The efficiency of the three transactions was high, both in terms of the first and second dimension of efficiency: It is highly unlikely that another cooperation strategy and/or way of employing positive incentives could have secured comparable or superior behavioral changes on the part of the three applicant countries at a lower or comparable cost.

Case Study V: From early 1994 on, the G-7/EU and Ukraine were engaged in negotiations over the premature closure of the Chernobyl NPP. The closure of the remaining operational units of the Chernobyl NPP (units 1 and 3) had become an object of contention due to the Ukrainian parliament's October 1993 decision to rescind its earlier resolution to close these two units by the end of 1993 and to upgrade the ill-fated plant for long-term

operation. Deeply concerned about the prospect of the crippled and highly symbolic Chernobyl NPP being granted a new lease on life, the G-7/EU sought to induce the Ukrainian government to close Chernobyl units 1 and 3 as soon as possible and to refrain from restarting Chernobyl unit 2. After almost two years of diplomatic wrangling over the amount of money requested by the Ukrainian government, the negotiating parties concluded in December 1995 a Memorandum of Understanding (MoU) in which the Western donors agreed to provide $2.3 billion in assistance in exchange for the closure of the Chernobyl NPP by 2000. The MoU envisaged around $500 million in grants for various projects related to the plant's early closure and $1.8 billion in loans for the completion of the two partly built Khmelnitsky-2 and Rovno-4 reactors (the so-called K2/R4 project) and the modernization of existing hydroelectric and thermal power plants. Implementation of the MoU turned out to be a problem-ridden and bumpy process, mainly because disagreement prevailed over the question of whether the Western donors should fund the K2/R4 project which had been found by an independent panel of experts not to represent the least-cost investment for Ukraine's energy needs. Nevertheless, on 15 December 2000, a year later than anticipated by the MoU and only days after the Western donors had tentatively approved loans for the K2/R4 project, the Ukrainian government ordered the definitive closure of the Chernobyl NPP. The effectiveness of the transaction was rather high: Despite some delay, the provision of positive incentives succeeded in inducing and enabling the Ukrainian government to prematurely close the Chernobyl NPP. Although the transaction was efficient in the sense that the employment of no other cooperation strategy could have led to a more favorable result (first dimension of efficiency), it is highly likely that the Western donors could have secured at least a comparable behavioral change on the part of Ukraine at a lower cost by employing positive incentives in a different way (second dimension of efficiency).

It should be noted that one transaction that materialized in the nuclear safety field has been excluded from analysis: In June 1995 the NSA concluded a grant agreement with the Russian Federation in which it agreed to allocate ECU 76 million for various safety upgrade projects at three Russian NPPs. I have opted to exclude this transaction from analysis because the NSA grant agreement with the Russian Federation did not contain any strict closure requirements. Indeed, in exchange for the NSA grants the Russian government merely pledged to set up new regulatory regimes for the continued operation of ten of the country's 15 oldest nuclear reactors and to incorporate least-cost energy planning considerations into

the licensing process of these units.[1] In short, since the degree of conditionality in this NSA agreement was rather low in the sense that the Russian government was not obliged to undertake costly, risk-eliminating behavioral changes, I have refrained from conducting a case study on the transaction between the NSA and the Russian Federation.

Each case study conducted in this book is basically designed to analyze a transaction between one donor, or group of donors, and a recipient country. One specific case study, however, departs from this basic structure: In *Case Study IV* three distinct transactions between one donor—the European Commission—and three different recipient countries—the Slovak Republic, Lithuania and Bulgaria—are examined in the context of a separate and single case study. The following reasons explain why I have opted to analyze these three transactions not in the three preceding case studies (*Case Studies I-III)*, but in the context of a separate and single case study. To begin with, although the transactions analyzed in *Case Study IV* constitute in effect a sequel of the transactions examined in *Case Studies I-III*, the former transactions differ from the latter in that they involve a different donor. Indeed, since it was evident by 1998 that the efforts of the EBRD and the NSA to secure the premature closure of high-risk nuclear reactors in the Slovak Republic, Lithuania and Bulgaria had failed or were likely to fail, the European Commission intervened into the ongoing closure dispute and sought to extract "realistic" closure commitments from all three Eastern European applicant countries by employing a combination of negative and positive incentives.

Second, there are practical reasons for examining the transactions between the European Commission and the three applicant countries in a separate case study. A significant part of *Case Study IV* explores the political and economic background to the European Commission's intervention into the closure dispute. Since it would be impractical to elaborate on this important background information in *Case Studies I-III*, I have decided to construct a separate case study which first provides this information and then examines the individual bargaining processes between the European Commission and the three applicant countries. Finally, practical reasons also explain why I integrated the three distinct transactions into one

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[1] Specifically, the Russian government pledged to guarantee the proper functioning of the Russian nuclear safety authority (GAN) and to introduce new licensing procedures for the country's oldest nuclear reactors. In addition, the Russian authorities agreed to perform in-depth safety assessments both on the eight nuclear reactors slated to be upgraded under the NSA agreement and on units 1 and 2 of the Kursk NPP. On the basis of these safety assessments, GAN was expected to determine whether these ten nuclear reactors complied with the new licensing regime and what kind of safety improvements would be required to justify their continued operation beyond 1997/1998. The Russian government also agreed not to restart Kursk unit 1 before 1998, and only then if the new licensing procedures were in place and the in-depth safety assessments had been carried out (NW, 17 April 1997: 1, 6-8).

single case study and refrained from conducting three individual case studies on these transactions. Since the European Commission's attempt to extract "realistic" closure commitments from the three applicant countries was undertaken in the context of ongoing EU membership negotiations, the bargaining processes between the European Commission and the three applicant countries were all rather similar. Thus, in order to avoid onerous repetitions, I have opted to analyze these three distinct transactions in the context of one single case study.

This study goes beyond the existing political science literature in terms of its empirical coverage of the nuclear safety problem in CEE and the FSU. The following brief review of the few existing studies on this specific issue-area of international environmental politics seeks to substantiate this claim. Barbara Connolly and Martin List (1996) have arguably produced one of the most informative analyses of the international effort to reduce the risk of nuclear accident in CEE and the FSU. Their study highlights a host of contractual and other problems the Western donor countries encountered when providing nuclear safety assistance in exchange for commitments on the part of Eastern European governments to prematurely close unsafe Soviet-designed nuclear reactors. Prominent among the problems they identify are the Western nuclear lobby's capture of the nuclear safety assistance programs, coordination problems among the donor countries and the risk that nuclear safety assistance would prolong the service lives of slightly improved, nevertheless still unsafe nuclear power plants. Their empirical findings are intriguing and have provided invaluable input to this study. Nevertheless, their study suffers from a number of shortcomings. First, their empirical analysis focuses on the overall Western approach to the nuclear safety problem and thus fails to examine in detail and over time the various transactions that materialized between the Western donors and the Eastern recipient countries. In this respect the authors of this study can be reproached for simply lumping different transactions into one case study. Second, Connolly and List exclude almost completely from discussion a number of important transactions, in particular those between the Western donor states and the countries of the FSU. Finally, their empirical analysis of the Western nuclear safety assistance programs extends only to the mid 1990s. It is therefore doubtful whether the rather limited timeframe of their analysis allows for definitive conclusions as to whether and how the identified problems had an impact on the effectiveness of the West's nuclear safety programs.

Robert Darst (1997, 2001) has also analyzed the nuclear safety problem in CEE and the FSU from a political science perspective. Specifically, he evaluates the Western response

to the safety threat posed by the continued operation of unsafe Soviet-designed nuclear reactors in terms of three risks inherent in resource transfers: Polluter life extension, environmental blackmail and moral hazard. While including an overview of the West's overall approach to the nuclear safety problem in CEE and the FSU and a brief discussion of the Western attempt to secure the premature closure of the Ignalina NPP in Lithuania, the main thrust of his empirical analysis focuses on the protracted bargaining process between the G-7 and Ukraine over the closure of the Chernobyl NPP. On the basis of this case study Darst explores the possibility of environmental blackmail in international environmental politics. Specifically, he seeks to determine how and why the Ukrainian government was successful in extracting a substantial amount of resources from the West by threatening to resuscitate the ill-fated Chernobyl NPP. His empirical analysis of the protracted negotiations between the G-7 and Ukraine is impressive and the conclusions he draws are convincing. However, Darst's account of the nuclear safety problem in CEE and the FSU is incomplete in various respects. To begin with, he focuses extensively on the transaction between the G-7 and Ukraine and fails to conduct in-depth case studies on the other transactions that materialized in the nuclear safety field. Moreover, his analysis of the bargaining process between the G-7 and Ukraine over the closure of the Chernobyl NPP is limited to the evaluation of only one problematic dimension of resource transfers, i.e. environmental blackmail. He thus ignores other important problems that affected the effectiveness and efficiency of this transaction.

In comparison to the existing studies discussed above, this book provides a more comprehensive and in-depth empirical analysis of almost all transactions that materialized in the nuclear safety field. Moreover, it explores a wider range of problems that have combined to hamper the Western donors' strategy of essentially "buying" nuclear safety from the countries of CEE and the FSU. Finally, the empirical analysis conducted in this book spans a much longer time period, i.e. from the early 1990s to late 2000. This extended timeframe makes it possible to analyze many important recent developments in the nuclear safety field that earlier studies could not take into account and thus allows for more informed judgments as to how and to which extent the identified problems shaped the effectiveness and efficiency of the various transactions that materialized in the nuclear safety field.

Key Results

The empirical analysis of the various transactions that materialized in the nuclear safety field suggests that the employment of positive incentives can be an effective policy tool to foster

international environmental cooperation. Indeed, in four examined transactions, the employment of positive incentives was rather effective in driving the behavior of the recipient in a direction desired by the donors. In addition, I did not find any outright failures in the sense that when positive incentives were provided they did not have any impact on recipient behavior. On the other hand, it cannot be denied that the effectiveness of positive incentives varied significantly across the examined transactions, and that all but one of the seven examined transactions failed to be fully effective. The most important problems in designing and implementing positive incentives that shaped the effectiveness of transactions were the following.

Information and distribution problems negatively affected the effectiveness of at least two examined transactions. Indeed, uncertainties regarding the "real" intentions of the recipient countries and incomplete information about the exact price and value of the object under negotiation and the most cost-effective approach to induce and enable the recipient countries to prematurely close unsafe nuclear reactors hampered the negotiation and/or implementation of agreements. Moreover, the efforts by recipient countries to gain the maximum amount of compensation in exchange for the least costly environmental measures, i.e. the latest possible closure schedules, often protracted negotiations.

Enforcement problems hampered the effectiveness of at least four examined transactions. On the one hand, the Western donors often lacked the means to enforce agreements. On the other hand, the Western donors proved to be rather reluctant to strictly enforce agreements. This had much to do with the fact that strategic or economic policy goals often overshadowed environmental objectives. In other words, donors were often unwilling to put their strategic and/or economic policy goals at risk for the sake of securing recipient compliance with international environmental agreements. This reluctance to enforce agreements was reinforced by a widespread perception that the capacities of the Eastern recipient countries to cooperate in the nuclear safety field were seriously constrained and that this was one of the main reasons why the recipients were unwilling to comply with closure commitments.

The "*slippery slope effect*" proved to be a problem that seriously hampered the effectiveness of transactions. In two examined transactions, the provision of Western funds for near-term safety upgrades at unsafe Soviet-designed nuclear reactors encouraged and enabled the recipient countries to keep their slightly improved, nevertheless still unsafe nuclear reactors in operation beyond the scheduled closure dates. In other words, the funding

of capacity-building measures designed to enable the recipient country to adopt a new, desirable behavior had the unintentional and perverse effect of increasing the recipient's incentives and capacities to continue its previous, undesirable behavior, albeit at somewhat lower levels of risk.

Finally, *coordination problems* among the donors also proved to be a serious problem in driving the behavior of the recipients in a direction desired by the donors. Coordination problems negatively affected the effectiveness of at least three transactions either by preventing donors from taking decisive action and mobilizing a sufficient amount of resources or by undermining Western attempts to establish a united donor front capable of imposing closure conditions on recipients.

The empirical analysis presents a somewhat more ambivalent picture regarding the efficiency of positive incentives. On the one hand, all examined transactions were efficient in the sense that no other cooperation strategy could have secured comparable or superior behavioral changes on the part of the recipient countries at a lower or comparable cost. This finding has much to do with the fact that under conditions of strong asymmetric preferences and capacities, the employment of positive incentives is often the only practical cooperation strategy. Moreover, the efficiency of the examined transactions was not negatively affected by *extortion* or *moral hazard problems*. Indeed, none of the Eastern recipient countries bluffed the Western donors into assuming that they would prolong the service lives of their unsafe nuclear reactors if not paid for refraining from doing so. The Eastern recipient countries either did not explicitly threaten to prolong the safety threat posed by their unsafe nuclear reactors if not compensated for, or if they did, as in the case of Ukraine, they would have probably delivered on their threat if the Western donors had refused to provide compensation. In addition, the empirical analysis did not uncover any compelling evidence that the Eastern recipients engaged in moral hazard behavior. Indeed, it is rather unlikely that the prospect of gaining Western nuclear safety assistance induced the Eastern recipient countries to accept higher levels of risk at their nuclear facilities and to refrain from investing their own resources to alleviate the nuclear safety problem.

On the other hand, it must be emphasized that all but three of the examined transactions involved potentially serious inefficiencies in the sense that the Western donors could have possibly secured comparable or superior behavioral changes on the part of the Eastern recipient countries at a lower or comparable cost by employing positive incentives in different ways. The most important problem that shaped the efficiency of transactions in this

respect relates to how the donors defined the environmental problem at hand, or in other words to the specific *problem-definition* adhered to by the donors. Indeed, in most examined transactions the Western donors adopted a rather one-sided problem-definition that was closely geared to the commercial interests of their domestic nuclear industries and/or to their own political and strategic interests. This specific problem-definition resulted in a strong pro-nuclear bias in the Western donors' funding strategy that ultimately precluded the funding and implementation of other, potentially more cost-effective capacity-building measures designed to solve the nuclear safety problem in CEE and the FSU.

This book is structured along the following lines. Chapter 2 develops the analytical framework that is designed to evaluate the effectiveness and efficiency of positive incentives in international environmental politics. Chapter 3 provides an introduction to the physical and political basics of the nuclear safety problem in CEE and the FSU. Chapters 4 to 8 form the heart of this book: They contain detailed case studies on the various transactions that materialized in the nuclear safety field. Finally, the results of the five in-depth case studies are summarized and compared in chapter 9.

Do ut des (give in order to receive)
- A basic axiom of all social sciences

2 ANALYTICAL FRAMEWORK

The analytical framework that guides the empirical research conducted in this book is structured as follows. In the first section I define some of the key concepts used in this study, discuss the theoretical and practical relevance of the research question and review the state of the art on positive incentives and international cooperation. In the second section I explore from a theoretical perspective when positive incentives are most likely to be employed. This section demonstrates that positive incentives are an important means to foster international cooperation in externality situations involving asymmetric preferences and/or capacities. In the third section I introduce the theoretical starting point for analyzing the effectiveness and efficiency of positive incentives with a discussion of the intriguing findings by Ronald Coase. This section elaborates on Coase's general proposition that market transactions can solve externality problems in a socially optimal way and that transaction costs pose the most serious obstacles to such pareto-improving exchanges. In the fourth and final section of this chapter I further develop this general proposition by systematically identifying which types of transaction costs are critical to successful cooperation and how they can be reduced or overcome. This section is structured into two parts. The first part elaborates on the outcomes to be explained, i.e. the effectiveness and efficiency of transactions, and discusses how these concepts are measured. The second part focuses on the explanatory concepts of the basic analytical framework and specifies eight problems that may arise when designing and implementing positive incentives in international environmental politics.

2.1 Key Concepts, Relevance of Research Question and State of the Art

The following section is structured as follows. In a first step I outline the research question and define some of the key concepts used in this study. In a second step I discuss the practical and theoretical relevance of the research question and review the existing political science literature on positive incentives and international cooperation in order to establish the state of the art.

Research Question and Key Concepts

This study aims to enhance our theoretical and practical knowledge on the advantages and drawbacks of a commonly used, nevertheless far from adequately understood policy instrument designed to facilitate international environmental cooperation: Positive incentives. Specifically, I address the following research question: *When and how can positive incentives foster international cooperation aimed at solving transnational environmental problems in an effective and efficient way, and what are the problems that arise in employing this policy instrument.* The research question contains several key concepts that are outlined below.

In this study I examine ways and means to cope with so-called transnational environmental problems. An environmental problem is *transnational* when it has or threatens to have negative effects on the environment not only within, but also outside the borders of the country in which its causes lie. On an abstract level, we can liken transnational environmental problems to those situations involving what social scientists commonly refer to as negative externalities. *Negative externalities* are the costs resulting from the production or consumption of goods that are not included in the price of these goods and negatively affect third parties. Thus, whenever the behavior of one state imposes costs on other states—in the environmental realm typically in the form of pollution and other undesirable side effects of economic activity—a situation involving negative externalities arises. Negative externalities affecting the natural environment can be distinguished in terms of their scale. Most negative externalities in the environmental realm occur on a regional scale. For example, air pollution originating from heavy industry in the United Kingdom during the 1960s and 1970s threatened to destroy large forest tracts in Scandinavia, or the chloride emissions of French mines into the river Rhine seriously affected waterworks and farmers in downstream states such as the Netherlands. More recently negative externalities affecting the natural environment have been increasingly observed on a global scale. For example, ozone-depleting chemicals, produced and consumed in any country of the world, threaten to destroy the life-preserving stratospheric ozone layer for everyone. Carbon dioxide resulting from the combustion of fossil fuels contributes to climate change that threatens to have unpredictable and irreversible global environmental effects. And future generations in all nations of the world may suffer, albeit in ways not yet known, by a loss of biodiversity in tropical forests (Keohane and Levy 1996).

Situations involving negative externalities generate a demand for international cooperation.[1] This is so because in such situations the externality-generating behavior of one or more states imposes unintended costs on other states. The states bearing the costs of the negative externality—the so-called victim states—have an interest to alleviate the negative externality. They will thus try to induce the externality-generating state—the so-called perpetrator state—to alter its undesirable behavior. A cooperative outcome in such situations is achieved whenever the perpetrator state adopts its behavior to the preferences of the victim states, i.e. when it alleviates or eliminates the negative externality it produces by its current or previous behavior. Thus for the purposes of this study I define *international cooperation* as the process by which a perpetrator state adjusts its behavior in response to influence attempts by victim states and thereby reduces the negative effects of its behavior on victim states.

Achieving and sustaining cooperative outcomes in international environmental politics is by no means an easy venture. Since states are assumed to behave rationally in the sense that they try to maximize their utility, states will often only engage in international cooperation and alter their behavior when they perceive an appropriate balance of cost and benefits in doing so. One common way of inducing states to cooperate is to provide incentives. Basically, two types of incentives can be distinguished, negative incentives (sanctions and threats) and positive incentives (side-payments and compensation). Positive incentives can materialize in two distinct ways: Either by the provision of material incentives within the issue-area currently under negotiation between two or more states or by linking various non-related issues with each other (positive issue-linkage). This study focuses on the former type of positive incentives and defines *positive incentives* as transfers of positively valued resources, such as money, technology, or know-how, from one actor to another with the aim of driving the behavior of the recipient in a direction that is desirable from the point of view of the provider.

The primary aim of this study is to explore the conditions under which the employment of positive incentives can be an effective and efficient means to foster international environmental cooperation and alter the externality-generating behavior of recipient countries. Hence, the outcomes to be explained in this study are the effectiveness

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[1] Externalities can be either negative or positive. A demand for cooperation can certainly also arise in situations involving positive externalities, for example when a producer of a positive externality seeks to induce those actors benefiting from the positive externality to contribute to the costs of its production. However, to simplify matters I limit the following discussion to situations involving negative externalities, which indeed are more often experienced in international environmental politics.

and efficiency of positive incentives. When assessing the effectiveness of positive incentives, I am interested in determining how successful the employment of positive incentives was in causing the recipient country to alter its externality-generating behavior, either by behaving in ways it would otherwise not or by terminating or redirecting prior patterns of behavior. The *effectiveness* of positive incentives is thus defined as the extent to which the provision of positive incentives drove the recipient country's behavior in a direction desired by the provider state and thus reduced the negative externality at hand.

The *efficiency* of positive incentives is a somewhat more complex concept. When assessing the efficiency of positive incentives, I am basically interested in determining whether the employment of positive incentives was cost-effective in driving the recipient country's behavior in a direction desired by the donor state. In other words, the efficiency of positive incentives relates to the question of whether the provider countries paid too much for what they gained in terms of environmental benefits resulting from the behavioral changes of the recipient country. The concept of efficiency used in this study encompasses two related, nevertheless distinct dimensions. The *first dimension of efficiency* relates to the question of whether the employment of cooperation strategies other than positive incentives could have led to comparable or superior externality-reducing behavioral changes on the part of the recipient country at a lower or comparable cost. This question is based on the assumption that different cooperation strategies vary in terms of their cost-effectiveness in reducing negative externalities. The *second dimension of efficiency* relates to the question of whether alternative ways of employing positive incentives could have led to comparable or superior externality-reducing behavioral changes on the part of the recipient country at a lower or comparable cost. This question takes into account that provider countries typically have a choice to fund different measures aimed at enabling the recipient country to alter its externality-generating behavior, and is based on the assumption that different capacity-building measures vary in terms of their cost-effectiveness in reducing negative externalities.

Finally, I am interested in examining the *problems* that arise when designing and implementing positive incentives in international environmental politics, and how these problems can be overcome. The theoretically derived problems that appear in relation to transactions are hypothesized to negatively affect the effectiveness and/or efficiency of positive incentives. They are thus the explanatory variables of the analytical framework. These problems are outlined in detail in the final section of this chapter.

Relevance of Research Question and State of the Art

Analyzing the effectiveness and efficiency of positive incentives and examining the problems that may arise when employing this cooperation strategy is relevant both from a practical and theoretical point of view. On the practical side, the use of positive incentives has become increasingly frequent and potentially important in international environmental politics in recent years. In the past, states typically sought to cope with transnational environmental problems by concluding international declarations and conventions on the protection of the natural environment or by establishing new international organizations and NGOs (Hurrell and Kingsbury 1992; Bergesen and Parmann 1994). However, by the late 1980s various concerned governmental and non-governmental actors realized that this approach was not working effectively in many areas of international environmental affairs. Specifically, it had become evident that the effective solution of an increasing number of transnational environmental problems depended on the active cooperation of so-called capacity-poor countries, i.e. in particular developing countries or countries in transition, and that the latter were unable and/or unwilling to participate in cooperative ventures without the financial and technical assistance of wealthier countries.[2]

Hence, in the early 1990s a significant change in strategy occurred with the emergence of a number of international environmental assistance programs to low-capacity countries. It was the 1990 London amendment of the Montreal Protocol which for the first time in the history of international environmental politics formally entitled developing countries to obtain resource transfers from wealthier countries—in the order of $200 million—as compensation for their participation in and compliance with a global environmental agreement. Moreover, in the same year the World Bank's Board of Executive Directors established the Global Environment Facility (GEF) that is designed to support environmental programs in countries lacking the financial, technical and administrative means to cope with environmental problems of a regional or global nature. Finally, in 1992 the United Nations Conference on Environment and Development in Rio, the so-called Earth Summit, officially recognized the need for substantial resource transfers in the field of international environmental protection. The action plan adopted at this UN conference, the so-called Agenda 21, called for the transfer of resources in the order of $125 billion annually between 1993 and 2000 from the

[2] The notion that effective international cooperation to protect the natural environment required resource transfers from wealthy to poor countries was first popularized in 1987 by the so-called Brundtland report (Connolly and Keohane 1996: 13).

rich to the poor countries to address at least the most urgent environmental problems (Sand 1999; Simonis 1994).

In short, various concerned states and international organizations have in recent years recognized that resource transfers are a potentially necessary means to solve a number of regional and global environmental problems and as a result have increasingly resorted to this cooperation strategy. On the other hand, the experience of the past decade shows that the resources potential donor states are willing or able to allocate for transnational environmental issues often fall short of the required amount. Indeed, only a relatively small fraction of the sum called for at the United Nation's 1992 Earth Summit has been mobilized since, and as the United Nations Commission on Sustainable Development has realistically concluded, "the outlook for the growth of aid from industrialized countries is bleak" (Blumenfeld 1994: 3). Hence, both the growing popularity of resource transfers in international environmental politics and the obvious need to use as efficiently as possible the often limited amount of resources available for international efforts to combat transboundary environmental degradation testify to the practical relevance of the research question pursued in this study.

This study is also relevant from a theoretical point of view since the existing political science literature on positive incentives generally fails to systematically explore the conditions under which positive incentives are successfully applied to foster international environmental cooperation and what kind of problems arise when bringing positive incentives to bear. The theoretical foundations for investigating the role of positive incentives were laid four decades ago by the economist Ronald Coase. In his seminal article "The Problem of Social Cost" (1960) Coase demonstrated that domestic disputes over negative externalities could be successfully resolved by bargaining among the producers and victims of negative externalities—i.e. in the absence of government intervention—and that the ultimate allocation of resources would be socially optimal, irrespective of the initial distribution of property rights. Moreover, Coase argued that the main obstacles to such welfare-enhancing exchanges were so-called transaction costs, i.e. the costs of negotiating and implementing such arrangements. In short, Coase proposed that market exchanges—for example compensation or side-payments—could lead to welfare-enhancing solutions of externality problems provided that the transaction costs of such exchanges were not too high.

Two decades after the publication of Coase's seminal article, John Conybeare (1980) discovered the relevance of his theoretical insights for the study of international politics. Conybeare's aim was to contest the international organization view that a federal world

government or other supranational structures were necessary means to deal with the growing number of international externalities. Specifically, he discussed Coase's theory with regard to several international problems, such as international trade and finance, nuclear proliferation and various other issues, in an attempt to demonstrate that market solutions to such problems were already globally efficient or could become efficient if property rights and liabilities were more clearly allocated. Conybeare's major contribution was to introduce Coase's arguments to international relations theory. However, he did not further develop Coase's arguments in the sense of identifying which types of transaction costs were crucial for efficient market solutions to international externality problems, nor did he systematically test the relevant propositions.

Prompted by the growing popularity of resource transfers in international affairs since the early 1990s, a small but growing number of researchers has in recent years rediscovered this older literature and has begun to explore in more detail when resource transfers may be successfully employed. The collaborative research effort led by Robert Keohane and Marc Levy is particularly noteworthy in this respect (Keohane and Levy 1996). The principal aim of this project was to examine the conditions under which resource transfers are effective in strengthening environmental policies in recipient countries. Towards this end the various contributors to this project conducted a number of case studies on environmental assistance programs to Central and Eastern Europe and various developing countries. Many of the empirical findings derived from the individual case studies are certainly valuable from a policy-oriented point of view and have also to a certain extent informed my own research. Nevertheless, the findings have certain limitations, in particular due to the project's rather broad research design. Specifically, the analytical framework that guides the contributors' empirical research does not systematically derive from theory the major problems in designing and implementing resource transfers. Rather, it is built around three causal pathways dubbed the three C's—i.e. sufficient *concern*, solutions to *contracting* problems, and adequate *capacity*—which are hypothesized to determine the effectiveness of resource transfers. However, the conditions under which these three causal pathways are activated are not derived from theory and specified in the analytical framework, but are explored within the individual case studies. As such the findings of this collective research effort generally fall short of providing theoretically informed and systematic knowledge on the role of positive incentives in fostering international environmental cooperation.

In two publications Robert Darst (1997, 2001) has analyzed the risks of the strategy Western countries have adopted to deal with various transnational environmental problems originating from the countries of the FSU: Resource transfers, or what he terms "transnational subsidization". Darst hypothesizes that in international environmental affairs this strategy gives rise to three main risks: Resource transfers may encourage greater environmental risk-taking by potential recipients (moral hazard), result in what he dubs "polluter life extension"—i.e. the modernization, rather than replacement, of polluting facilities—and lead to blackmail attempts by would-be recipients. He then discusses various cases of East-West environmental cooperation to explore when and how these three risks may hamper the effectiveness of environmental assistance programs, and what kind of strategies donors can pursue to minimize them. By highlighting three important problems that may arise when employing positive incentives, Darst has certainly contributed to our understanding of this cooperation strategy. Nevertheless, since he focuses on merely three problematical dimensions of this cooperation strategy, his work falls short of providing a systematic and exhaustive account of the role of positive incentives in fostering international environmental cooperation.

Other major theoretical work on positive incentives and international cooperation can be found in a series of working papers by Ronald Mitchell and Patricia Keilbach (1998, 1999). Seeking to explain variation in the mechanisms international institutions typically adopt to alter state behavior, these two researchers have demonstrated that depending on situation structure states tend to resort to different cooperation strategies. Although their theoretical argument does not explain under which circumstances positive incentives are effective and efficient in promoting international cooperation, it is nonetheless of relevance for the purposes of this study because is provides interesting insights as to when, i.e. in what kind of situation structure, positive incentives are likely to be employed by states. Their findings will thus be outlined in more detail in a separate section of this chapter.

Thomas Bernauer and Dieter Ruloff (1999) have conducted the most explicit research so far on the advantages and drawbacks of positive incentives in fostering international cooperation. The major contribution of the collaborative research project led by these two political scientists was to develop a coherent analytical framework to analyze the effectiveness and efficiency of positive incentives and to systematically evaluate their theoretical propositions by means of case studies in the field of arms control and nuclear non-proliferation. Obviously, my research draws extensively on the theoretical work of that

project. Nevertheless, this study is distinct in two respects: First, it rectifies a number of incoherent or weak spots in the theoretical arguments of Bernauer and Ruloff and expands on their work by integrating recent theoretical insights. Second, it explores the role of positive incentives in a different issue-area of international politics, i.e. in international environmental affairs. In sum, by building upon and synthesizing the theoretical insights of recent research this study aspires to close a number of research gaps in the theoretical literature on positive incentives and international cooperation.

2.2 Situation Structure and the Employment of Positive Incentives

When are states likely to employ positive incentives to promote international environmental cooperation and why? Drawing extensively on recent work by Mitchell and Keilbach (1999) and Mitchell (1998, 1999), this section aims to provide a theoretically informed answer to the question above. This section is structured along the following lines. In a first step I describe three different types of externality situations states commonly face when seeking cooperative outcomes. In a second step I outline three strategies that states may employ to promote international cooperation: Positive incentives, negative incentives and issue-specific reciprocity. Finally, I discuss in which externality situation which of the three cooperation strategies is likely to be employed by states.

It has already been pointed out that externalities resulting from the uncoordinated behavior of one or more states generate a demand for international cooperation. The logic behind this argument is straightforward: In an interdependent world, the uncoordinated behavior of one or more states often imposes unintended costs on other states, and those states bearing the costs of the externality have an incentive to promote cooperation. The existing literature on international cooperation generally builds upon the argument that externality situations generate a demand for cooperation. However, many analysts of international cooperation have overlooked the fact that externality situations differ in terms of their underlying structures. Mitchell and Keilbach (1999) have rectified this shortcoming in the existing literature by demonstrating that the structure of externality situations varies along two significant dimensions. One dimension of situation structure relates to the interacting states' *preferences to cooperate*: In some externality situations all interacting states are dissatisfied with the status quo and thus have incentives to cooperate, even though the payoffs of cooperation may be unevenly distributed. Thus, their preferences to cooperate are symmetric. In other externality situations not all interacting states are dissatisfied with the status quo and

some states may therefore have no incentives to cooperate. Their preferences to cooperate are thus asymmetric. The other dimension of situation structure relates to the interacting states' *capacities to cooperate*: In some externality situations all interacting states are capable of cooperating in the sense that they dispose over the financial, technical and administrative means to alter their externality-generating behavior. Thus, their capacities to cooperate are symmetric. In other situations not all interacting states have the capacity to alter their externality-generating behavior. Their capacities to cooperate are thus asymmetric.[3]

In short, on the basis of whether the interacting states' preferences and/or capacities to cooperate are symmetric or asymmetric, we can broadly distinguish among three different types of externality situations states commonly face when seeking to achieve cooperative outcomes. In the following I delineate these three differently structured externality situations with the help of simple examples derived from international environmental politics.

Externality Situations Involving Symmetric Preferences and Capacities

The underlying structure of such externality situations is best illustrated by the following example involving a lake being shared by two relatively affluent states. Assume that each state uses the lake for drinking water purposes and that each state pollutes the lake with sewage. In this simple example both the preferences and capacities of the two states to cooperate are symmetric. Their preferences are symmetric because both states are dissatisfied with the status quo. Indeed, each state generates an externality that imposes costs on the other—the lake water is undrinkable for both states due to the mutual disposal of sewage into the lake. In this example there is no clear-cut distinction between victim and perpetrator state because each state perceives itself as being victimized by the externality-generating behavior of the other. Since both states are dissatisfied with the status quo, they both have incentives to cooperate: Each state reckons that the net-benefits to be gained from collectively abating pollution exceed the net-benefits of both the status quo and of unilaterally abating pollution. Their capacities to cooperate are symmetric because both states dispose over the financial,

[3] The existing literature on international cooperation generally fails to take these two dimensions of situation structure into account. Indeed, most theories of international cooperation posit that states cooperate either to achieve common interests or to avoid common aversions. In other words, it is assumed that all interacting states are dissatisfied with the status quo and that all states have incentives to cooperate. At the same time it is also implicitly assumed that all interacting states are capable of adopting alternative behaviors that can alleviate the externality. Consequently, international cooperation is often analyzed with respect to only one specific type of situation, i.e. when both the preferences and capacities of interacting states to cooperate are symmetric (Mitchell and Keilbach 1999; Mitchell 1999).

technical and administrative means to alleviate the externality, for example by building and operating expensive sewage disposal plants.

Although all interacting states have an interest to cooperate in such externality situations, they still face incentives to defect. This is so because in such situations each state may reckon that it could gain even larger net-benefits from unilateral defection than from mutual cooperation. The example above illustrates this incentive structure: While both states perceive benefits in collectively building and operating expensive sewage disposal plants, each state prefers that the other build and operate a sewage disposal plant while abstaining from such costly action itself. However, if both states act upon this incentive structure, they will be unable to overcome the uncooperative status quo, even though both states perceive the status quo as suboptimal.[4] In short, even when interacting states share symmetric preferences and capacities to cooperate, they are still confronted with incentives to defect. As a result, it may be difficult for the interacting states not only to achieve, but also to sustain cooperative solutions to externality problems.

Externality Situations Involving Asymmetric Preferences

A typical example for situations involving asymmetric preferences is a river being shared by two states, with one state located upstream and the other downstream. Assume that both states pollute the river while also using it for drinking water purposes. In this example, the interacting states' preferences to cooperate are asymmetric: The downstream and upstream states do not share a mutual dissatisfaction with the status quo and consequently they do not have similar incentives to cooperate. The downstream state is certainly dissatisfied with the status quo because it is harmed by the externality produced by the upstream state. The downstream state (the victim state) thus prefers a cooperative outcome in which the upstream state (the perpetrator state) alters its externality-generating behavior. The upstream state, however, is not necessarily dissatisfied with the status quo because the costs of its externality-generating behavior can be almost fully externalized. Moreover, the upstream state is not harmed by the pollution produced by the downstream state. Since the upstream state has no or only few incentives to incur the costs of pollution abatement, it prefers the status quo to any

[4] In game theoretic terms, the incentive structure underlying the lake example above is that of a mixed motive game such as the well-known "Prisoner's Dilemma" or the "Tragedies of the Commons". Situations involving symmetric preferences and capacities also resemble coordination games in which all interacting states are indifferent among the possible coordinated outcomes so long as the uncoordinated status quo outcome is avoided.

cooperative outcome. The aforementioned example of two states sharing a lake can also involve asymmetric preferences if we include the assumption that one state has alternative sources of drinking water (state A) and the other does not (state B). State A may be indifferent to the pollution produced by state B precisely because it has alternative sources of drinking water. State B, however, is not indifferent to the pollution produced by state A because it depends on the lake for its drinking water. State B therefore prefers a cooperative outcome in which state A stops polluting the lake. In short, states face considerable cooperation problems in situations involving asymmetric preferences.

The two examples outlined above indicate that asymmetric preferences can arise for many reasons. In the following I elaborate on one important reason why states typically face asymmetric preferences in international environmental politics: *Large income differentials between states*. It is widely assumed that with increasing income per capita, the demand for so-called "post-material" goods such as environmental protection grows. The governments of developed countries whose populations already enjoy relatively high standards of living tend to be willing to engage in international environmental cooperation. This is so because their populations place a relatively high premium on a clean environment and thus lobby their respective governments for internationally coordinated environmental measures (Cairncross 1992; Turner et al. 1994). The governments of less well-off states, however, often lack the incentives to engage in international environmental cooperation. On the one hand, the governments of poor countries face more painful trade-offs than governments of rich countries. Indeed, since the financial, technical and administrative resources of hard-pressed countries are highly constrained, their choices involve severe opportunity costs: Resources devoted to environmental protection can no longer be used for other urgent needs such as economic development. As a consequence, governments of poor states tend to discount the future benefits of environmental protection more than governments of rich countries. On the other hand, they face practically no internal pressure to engage in international environmental cooperation due to the absence of large domestic constituencies calling for environmental protection. In sum, large differences in per capita income do not only determine the discrepancy between existing levels of environmental quality in rich and poor countries, but also their respective preferences to engage in international environmental cooperation (Connolly and Keohane 1996: 12-13).

Externality Situations Involving Asymmetric Capacities

In contrast to situations involving asymmetric preferences in which the perpetrator state lacks incentives to cooperate, the fundamental cooperation problem in situations involving asymmetric capacities relates to the insufficient capacities on the part of the perpetrator state to alter its externality-generating behavior. Indeed, even if the perpetrator state prefers to cooperate, the lack of domestic financial, technical or administrative resources may prevent the perpetrator state from alleviating the externality it produces. Such problems have been frequently observed in North-South and East-West environmental politics in which the poorer countries of the South and Eastern Europe have experienced considerable difficulties in implementing environmental projects or complying with international environmental agreements (Keohane and Levy 1996). We can thus characterize situations involving asymmetric capacities as those situations in which the victim state prefers that the perpetrator state adopt some new externality-reducing behavior that the perpetrator state may prefer to adopt but cannot.

Although the clear-cut distinction between situations involving asymmetric preferences and situations involving asymmetric capacities is certainly useful for analytical purposes, in reality the distinction may prove elusive since capacity problems on the part of the perpetrator state tend to influence its own preferences for cooperation. In this respect capacity problems are endogenous to problems of asymmetric preferences: States with insufficient financial, technical or administrative capacities tend to abstain from participating in international environmental negotiations and from entering into international agreements. States can thus also face situations in which both preferences and capacities are asymmetric. In such situations the victim state prefers that the perpetrator state adopt some new externality-reducing behavior that the perpetrator state both does not want to and cannot adopt. However, to simplify matters I have refrained from categorizing a fourth type of situation involving asymmetric preferences and capacities.

Three cooperation strategies

The description of the three externality situations demonstrates that those states which prefer to cooperate, i.e. the victim states or those states dissatisfied with the status quo, encounter various obstacles in achieving and sustaining cooperative outcomes. Cooperation problems commonly arise due to one or a combination of the following three factors: Perpetrator states

may have incentives to defect, they may lack incentives to engage in cooperation or they may have insufficient capacities to alter externality-generating behavior. As a result, victim states must employ cooperation strategies to counter incentives to defect and to make cooperation a more attractive and possible course of action for the perpetrator state.

One cooperation strategy commonly employed by states involves the provision of positive incentives. However, states often have other cooperation strategies at their disposal, and depending on the circumstances, they may favor one cooperation strategy over the other. Consequently, the main question pursued in this section—i.e. when do states tend to rely on positive incentives to foster international cooperation and why—is best addressed by assessing when states are likely to use positive incentives instead of other available cooperation strategies. So what other types of strategies can states employ to foster international cooperation? To keep the following discussion as simple as possible, I limit the number of potentially available cooperation strategies to two alternative cooperation strategies: Negative incentives and issue-specific reciprocity. In the following I briefly describe each cooperation strategy.

Positive incentives—as conceptualized in this study—involve transfers of positively valued resources, such as money, technology, or know-how, from one actor to another. When adhering to a positive incentive strategy, the victim state makes the following contingent offer: It promises to provide positively valued resources if the perpetrator state agrees to alter its externality-generating behavior, but also threatens to withhold the provision of these resources if the perpetrator state refuses to cooperate. The victim state's contingent offer manipulates the material consequences of the perpetrator state's choice between cooperation and non-cooperation as follows: If the perpetrator state cooperates, it will receive the positively valued resources, but if it does not cooperate, it will be denied the provision of positively valued resources. The logic behind the conditional provision of positively valued goods is to make cooperation more attractive by increasing the net-benefits the perpetrator state believes it may gain from altering its externality-generating behavior. Apart from influencing the incentive structure of the perpetrator state, the provision of positively valued resources can also create new opportunities for the perpetrator state to engage in cooperation if it lacks the capacities to do so.

Negative incentives involve sanctions and threats designed to impose costs on other states. When adhering to a negative incentive strategy, the victim state makes the following contingent offer: It promises to abstain from imposing sanctions if the perpetrator state agrees

to alter its externality-generating behavior, but also threatens to impose sanctions if the perpetrator state does not cooperate. The victim state's contingent offer manipulates the material consequences of the perpetrator state's choice between cooperation and non-cooperation as follows: If the perpetrator state cooperates, it will evade the sanctions threatened by the victim state, but if it does not cooperate, it must be prepared to suffer the costs of the threatened sanctions. The logic behind the threat is to make cooperation relatively more attractive to the perpetrator state by increasing its perceived costs of not altering its externality-generating behavior.

Issue-specific reciprocity involves what other analysts of international cooperation have termed an "intertemporal linkage within an issue area" (Mitchell and Keilbach 1999). When adhering to a strategy of issue-specific reciprocity, the victim state makes the following contingent offer: It promises to adopt a desirable externality-mitigating behavior if the perpetrator state does likewise, but also threatens to continue or to revert to an undesirable externality-generating behavior if the perpetrator state refuses to cooperate or defects. The victim state's contingent offer manipulates the material consequences of the perpetrator state's choice between cooperation and non-cooperation as follows: If the perpetrator state cooperates, it will gain whatever benefits accrue to it from sustained mutual cooperation. However, if it does not cooperate, it will not gain whatever benefits accrue to it from sustained mutual cooperation, or in case of defection from a cooperative outcome, it will lose such benefits.

In the following I discuss in which of the three different externality situations which cooperation strategy—positive incentives, negative incentives or issue-specific reciprocity—is most likely to be employed by states.

Cooperation Strategies in Situations Involving Symmetric Preferences and Capacities

In such externality situations all interacting states are dissatisfied with the uncooperative status quo outcome and therefore have incentives to cooperate. Moreover, all interacting states have the capacity to achieve a cooperative outcome if they prefer so. However, states continue to face incentives to defect because each state prefers unilateral defection to mutual cooperation. Which cooperation strategy will states most likely adhere to in such situations? *Issue-specific reciprocity* has been identified by various analysts of international cooperation as the most promising cooperation strategy under such circumstances because it allows states to reach cooperative outcomes rather smoothly and usually provides states with an adequate

enforcement mechanism. On the one hand, issue-specific reciprocity resolves bargaining problems rather simply by providing strong and simple focal points for agreement. Imposing nominally equal obligations on all interacting states—for example all states halt their externality-generating behavior, reduce the externality they produce by equal amounts, or adopt some common process or technology to alleviate the externality—is often considered to conform to the criterion of fairness and tends to prevent the rise of "stingy" bargaining behavior by concealing the quite different compliance burdens and cooperation benefits involved (Mitchell and Keilbach 1999). On the other hand, issue-specific reciprocity can also resolve enforcement problems rather effectively. For example, in the lake example outlined above a state which free-rides on the pollution abatement efforts of the other can be induced to cooperate by retaliatory measures (i.e. retaliatory defection) on the part of the latter since each state prefers mutual cooperation to the non-cooperative status quo.

Although the employment of *negative or positive incentives* is conceivable in situations involving symmetric preferences and capacities, states are less likely to rely on these two cooperation strategies because issue-specific reciprocity provides a much more cost-effective and equitable way of achieving and sustaining cooperative outcomes. Nevertheless, it should be emphasized that negative or positive incentives may be employed by states to bolster a strategy of issue-specific reciprocity, especially then when the latter's enforcement mechanisms are inadequate. Indeed, in some circumstances, for example when there is a large number of interacting states, it may prove impossible to threaten retaliatory defection due to collective action problems or due to the difficulties involved in focusing the effects of retaliatory defection on the initial defector state (Mitchell and Keilbach 1999). Thus, under certain circumstances issue-specific reciprocity may require some fine-tuning with negative or positive incentives in order to counter incentives to defect.

Cooperation Strategies in Situations Involving Asymmetric Preferences

In such externality situations not all interacting states are dissatisfied with the uncooperative status quo outcome. The preferences to cooperate are therefore unevenly distributed among the interacting states: While the victim states have a strong interest in cooperation, the perpetrator states may prefer the uncooperative status quo. Which cooperation strategy will be most likely employed in such situations? *Issue-specific reciprocity* is bound to be ineffective in such situations because the preferences of the perpetrator state are independent of the issue-specific behavior of the victim state. Indeed, a downstream state will not be able to induce an

upstream state to change its externality-generating behavior by simply threatening to also pollute the river. The same logic applies to the example in which two states share a lake but in which one state has alternative drinking water resources while the other does not: The former state is unlikely to be enticed to stop polluting the lake by means of retaliatory defection by the latter.

Nevertheless, in situations involving less pronounced asymmetric preferences, states have occasionally adhered to two "soft" types of issue-specific reciprocity. In *lowest common denominator solutions* states conclude agreements in which each state accepts the same environmental obligations, for example the same amount of emission reductions. Such obligations are established at the level that the most reluctant state is willing to comply with. The resulting level of emission reductions is thus small enough to minimize cost and benefit differentials among the states with asymmetric preferences. Although such lowest common denominator solutions may be conducive to achieving cooperation, such a strategy is hardly desirable from the viewpoint of those states strongly interested in an effective solution to the problem since the resulting level of environmental protection measures is determined by the maximum offer of the least interested state, and in various instances, the least interested state may just prefer the uncooperative status quo. In *differential regulation* states conclude agreements in which all participating states in principle have equal environmental obligations, but which allow for exceptions and grace periods for those states least interested in complying with such obligations. Well-known international environmental agreements that provide for differentiated obligations include the second SO_2 Protocol under the LRTAP regime of the ECE and the Montreal protocol on the protection of the stratospheric ozone layer. Differential regulation promises to involve more substantial environmental obligations than lowest common denominator solutions because the resulting level of pollution abatement measures is determined more by the individual preferences of participating parties than by the maximum offer of the most reluctant state. However, even differential regulation may prove totally ineffective if the behavior of the perpetrator state is crucial to solving the environmental problem at hand and if it has no interest in changing its behavior.

In situations involving asymmetric preferences states will tend to rely either on *negative or positive incentives*. This is so because these two cooperation strategies directly address the fundamental cooperation problem in such externality situations: The perpetrator state's lack of interest to cooperate. Indeed, both negative and positive incentives are designed

to enhance the perpetrator state's incentives to cooperate by increasing the benefits and/or lowering the costs of cooperation to the perpetrator state.

Cooperation Strategies in Situations Involving Asymmetric Capacities

In situations involving asymmetric capacities states are likely to employ *positive incentives* because this cooperation strategy addresses the fundamental cooperation problem in such externality situations: Insufficient capacities on the part of the perpetrator state. Indeed, the transfer of money, technology and know-how can increase the capacity of perpetrator states otherwise not able—and thereby perhaps also not willing—to cooperate. In contrast, *negative incentives* are unlikely to be employed by states in such situations since the fundamental cooperation problem does not relate to the perpetrator state's lack of interest in cooperation, but to its insufficient capacities to cooperate. Although it is theoretically conceivable that negative incentives may coerce a perpetrator state into developing such capacities, in practice this is most unlikely to occur. *Issue-specific reciprocity* is also a non-starter in such situations since the issue-specific behavior of the victim state is unrelated to the perpetrator state's capacities to alter its behavior.

The discussion above allows us to return to the main question of this section: When are states likely to rely on positive incentives to promote international environmental cooperation and why? It has been shown that positive incentives are most likely to be employed by states in externality situations involving asymmetric capacities. Indeed, a positive incentive strategy is the only cooperation strategy discussed in this section which can adequately solve the fundamental cooperation problem—insufficient capacities—states encounter in this externality situation. Moreover, positive incentives have been identified as a promising cooperation strategy in situations involving asymmetric preferences. However, in contrast to situations involving asymmetric capacities, states are likely not only to rely on positive incentives, but may also employ negative incentives in such situations. Finally, positive incentives are less likely to be employed by states in situations involving symmetric preferences and capacities. Indeed, states will tend to rely on other cooperation strategies such as issue-specific reciprocity in such situations, although they may employ negative or positive incentives as a means to buttress or fine-tune a fundamentally reciprocal agreement.

2.3 The Coase Theorem

The previous section has demonstrated that in various instances of international environmental affairs, in particular in situations involving asymmetric preferences and/or capacities, victim states are likely to employ positive incentives in order to induce and/or enable perpetrator states to alter their externality-generating behavior. Put in other words: The victims of pollution often pay polluters to stop polluting. This widespread practice in international environmental affairs may be considered to be inappropriate or unfair from a legal or moral point of view because it violates the longstanding "Polluters Pay Principle", i.e. the internationally recognized principle that each state is responsible for controlling the transboundary effects of pollution generated within the borders of its national jurisdiction.[5] Nevertheless, given the absence of a supranational authority capable of enforcing the "Polluters Pay Principle", this practice should not be surprising. The fact that victim states often transfer resources to perpetrator states in order to promote international environmental cooperation gives rise to a crucial question: Are transfers of positively valued resources from one actor to another an effective and efficient means to solve international externality problems, and if so, under which conditions? Over four decades ago the economist Ronald Coase laid the theoretical foundations for addressing this question. Thus, in the following section I discuss his theoretical findings and highlight their relevance for the study of international environmental cooperation.

The idea that victims of pollution transfer resources to polluters is not new, nor is it a discovery of International Relations theory. In his seminal article "The Problem of Social Cost" (1960), Ronald Coase contested the conventional notion that governmental regulation was needed to resolve domestic disputes over negative externalities—i.e. pollution and other undesirable side effects of economic activity—and refuted the claim that the producer of a negative externality should automatically be made liable. Coase argued that under conditions of clearly defined property rights and a well-working market system the producer and the victim of an externality can engage in market transactions which will ultimately reduce the

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[5] The "Polluters Pay Principle" is enshrined in the United Nations 1972 Stockholm Declaration and in many other international environmental agreements concluded thereafter. Principle 21 of the Declaration of the United Nations Conference on the Human Environment (Stockholm Declaration) stipulates that "states have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or areas beyond the limits of national jurisdiction."

externality to the same, socially optimal level, irrespective of the initial distribution of property rights, i.e. regardless of which party has a right to create or prevent the externality. If the victim of pollution holds the right to a clean environment, then the polluter will pay the victim to accept that level of pollution at which the marginal benefit accruing to the polluter from an additional unit of production equals the marginal cost to the victim of an additional unit of pollution. In case the polluter has the property right to pollute, i.e. to create an externality, then the victim will pay the polluter to reduce emissions to the identical point at which the marginal benefit of an additional unit of a clean environment equals the marginal cost the polluter incurs from the foregone production. In short, when transactions costs, i.e. the costs of negotiating and implementing the exchange, are zero, the ultimate allocation of resources of such an exchange is the same and socially optimal, irrespective of the initial distribution of property rights. Subsequent commentators called this the “Coase Theorem“ (Darst 1997: 45).

It may be helpful to illustrate the rather abstract arguments outlined above on the basis of a simple example. Consider a situation in which the sulfur dioxide emissions of a steel mill negatively affect a landowner located down wind. Suppose that the pollution produced by the steel mill causes damages to the landowner in the order of $50'000 and that pollution can be eliminated by the installation of pollution control devices at a cost of $30'000. Assume further that the costs accruing to the landowner of shifting his land to a new use unaffected by the pollution amount to $20'000. Is it efficient or socially optimal for the government to intervene in this dispute and make the polluter—i.e. the steel producer—liable for the damages he causes? Contrary to conventional wisdom, it is not. If the government forces the steel producer to internalize all external costs of steel production, the steel producer will install pollution control devices and the dispute will be resolved at a cost of $30'000. If the government does not intervene in this dispute, the steel producer will continue to pollute and the landowner will change the use of his land, thereby solving the dispute at a cost of $20'000. Thus, in this specific case direct government intervention in favor of the landowner would have led to a socially sub-optimal solution to the externality problem.

This example can also be used to illustrate Coase’s argument that in the absence of transaction costs market exchanges between parties will result in the same and socially optimal solution of negative externality problems, irrespective of the initial distribution of property rights. Suppose that the steel producer has the legal right to pollute, which—as shown above—happens to be the most efficient solution. In this case the landowner will offer

the steel producer up to $20'000—i.e. an amount lower than the costs for changing the use of his land—to stop polluting. The steel producer, however, will turn down this offer since the installment of pollution control devices costs $30'000. The outcome will thus be that the steel producer continues to pollute and the landowner changes the use of his land. Now consider the opposite situation in which the landowner has the legal right to clean air. The outcome in this situation will be exactly the same—continued pollution and change in the use of the landowner's land—and also socially optimal. If the landowner insisted on pollution elimination, the steel producer would have to spend $30'000 on pollution control devices. However, the steel producer may offer the landowner an amount of, say, $25'000 for permission to pollute. Since this amount is higher than the costs of changing the use of his land, the landowner will be better off by accepting the offer and waiving his right to clean air. And the steel producer will also be better off since this amount is less than the costs of installing pollution control devices.[6]

Since Coase's reflections apply to negotiation and exchange situations without direct government intervention, his arguments are relevant also for transactions in the international realm whose fundamental feature is the absence of a supranational authority above the individual nation-states. Indeed, since the absence of a supranational authority in the international realm precludes vertical solutions to externality problems—with the partial exception of the EU—, states are effectively forced to seek horizontal solutions to such problems. With respect to international environmental affairs, the Coasian model applies to situations in which a state or a group of states may consider paying another state to restrict or forego its sovereign right to produce an externality. The exchange of money for environmental measures on the part of the recipient results in a reassignment of (property) rights: While the donor states provide resources, the recipient country waives its sovereign right to pollute and commits itself to a course of action otherwise costly to itself, but beneficial to the donors. Under conditions of zero transaction costs, such a voluntary exchange leads to an optimal allocation of resources, or in other words, to a pareto-efficient

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[6] The logic of Coase's argument also holds when the costs of pollution elimination involved in this example are lowered—say to $10'000. In this situation the steel producer will stop polluting, regardless of the initial distribution of property rights, and the outcomes will be socially optimal. If the steel producer has the legal right to pollute, the landowner will offer an amount of, say, $15'000 for a guarantee that pollution will be eliminated. The steel producer will accept this deal since the amount of money offered is larger than the costs of installing pollution control devices. If the landowner has the legal right to clean air, the steel producer will also stop polluting. Indeed, the largest amount the steel producer will be willing to offer for the permission to pollute is $10'000, i.e. an offer the landowner will decline.

reduction of the externality whereby at least one country is made better off and no country is made worse off by the exchange.

The pareto-efficient nature of such market exchanges under conditions of zero transaction costs may be best exemplified by contrasting a situation in which a downstream state pays an upstream state to stop polluting a river they both share with a situation in which the downstream state coerces an upstream state—for example with economic sanctions—into doing so. In the former situation involving resource transfers the downstream state benefits from reduced pollution levels but also compensates the upstream state for the losses it incurs from changing its behavior. If the amount of resources the downstream state provides is less than it gains in terms of reduced pollution levels and exceeds the abatement costs incurred by the upstream state, both states are better off. In the latter situation involving economic sanctions the downstream state will likely benefit at the expense of the upstream state that is not compensated for the costs it incurs from changing its behavior. Hence, in this situation the upstream state will be made worse off, or, if the sanctions employed by the downstream state prove to be overly costly, both states may be worse off.

The assumption of zero transaction costs, however, does not have much in common with the real world. Coase was aware of this and extended his analysis to include those real-world cases in which transaction costs were positive and in which disputes over the assignment of property rights existed. Coase demonstrated that even under such conditions the social value of production could be maximized if courts assigned property rights to the party with the higher transaction costs. Although transposing this argument from domestic settings to the international level is certainly possible, two important caveats must be taken into account when doing so. First, Coase's argument is based on the implicit assumption that there are courts that can assign and reassign property rights. This in turn presumes the existence of some sort of authoritative legal system with sufficient powers of enforcement. Second, even in those cases in which the initial assignment of property rights is not contested, his argument assumes that the costs of negotiating and implementing exchanges are not prohibitively high. This again presumes that an authoritative legal system is in place that parties can call upon in case contracts are breached. By contrast, at the international level there is neither an overarching government nor an authoritative legal system. As a result, transaction costs at the international level are often significantly higher than in domestic settings. Monitoring and enforcing international agreements are often more costly, and the risks that the parties to such an agreement will prove unable or unwilling to comply with

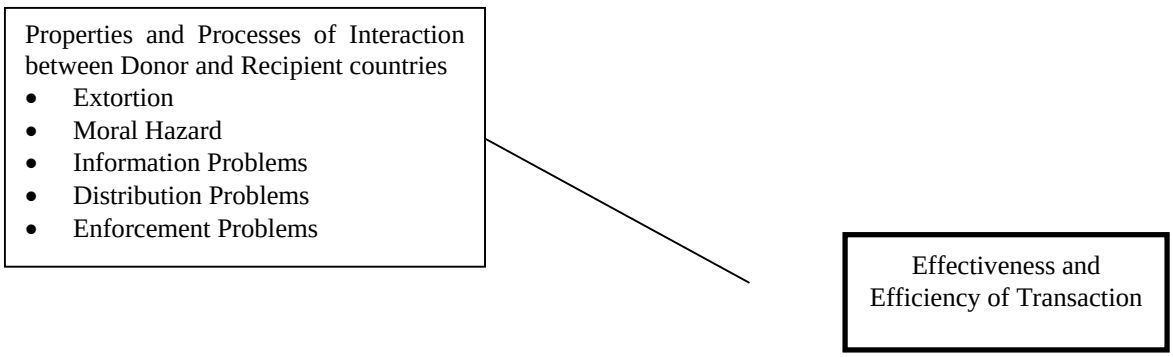
treaty obligations are higher. Finally, the very task of reassigning property rights in the international system and determining which party has the higher transaction costs is unlikely to be an easy undertaking (Darst 1997). Nevertheless, these qualifications do not call into question the general proposition that voluntary exchanges between victim and perpetrator states can lead to effective and efficient solutions to international externality problems. They rather suggest that for exchanges to be effective and efficient at the international level, interacting states must find means and ways to reduce or overcome transaction costs.

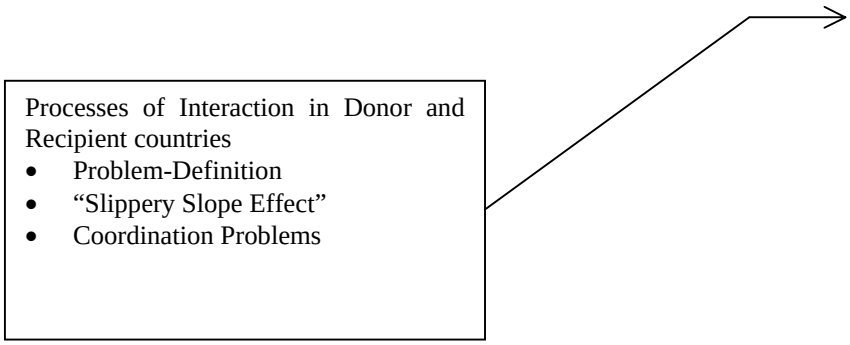
2.4 Basic Analytical Framework

The previous section has shown that a systematic analysis of transaction costs is key to answering the research question of this study: *When and how can positive incentives foster international environmental cooperation in an effective and efficient way, and what are the problems that arise in employing positive incentives.* Building upon recent theoretical work on positive incentives, in particular on the theoretical insights by Bernauer and Ruloff (1999), I develop in this section an analytical framework that provides for theoretically deduced propositions about which types of transaction costs are critical to the effective and efficient employment of positive incentives and how these transaction costs can be reduced or overcome.

The analytical framework developed in this section builds upon the following concepts. Positive incentives are conceptualized in terms of *transactions*, i.e. exchanges of money, technology, know-how for externality-reducing behavioral changes. *The outcomes to be explained* are the effectiveness and efficiency of a transaction. As shown in figure 1, the explanation operates at several levels of analysis and involves *two groups of explanatory concepts*: a) Properties and Processes of Interaction between Donor and Recipient Countries, and b) Processes of Interaction in Donor and Recipient Countries. The explanatory concepts are operationalized in terms of problems that arise when designing and implementing positive incentives and that may have an impact on the effectiveness and efficiency of a transaction.

FIGURE 2.1: BASIC ANALYTICAL FRAMEWORK





The theoretical propositions of the analytical framework boil down to the following *basic hypothesis*: The more the designated problems crop up in a transaction both in terms of their occurrence and intensity, or conversely, the less successful the provider states are in coping with these problems, the lower the effectiveness and/or efficiency of the transaction. That said, it must be emphasized that the analytical framework is not so much designed to allow for rigorous hypothesis testing but rather aims to provide a checklist of problems that typically arise when designing and implementing positive incentives. Indeed, this caveat should not be surprising with a view to the fact that it is next to impossible to precisely gauge the exact influence of each problem on the outcomes to be explained. Hence, the analytical framework is best viewed as a useful analytical tool to evaluate and explain in empirical cases whether and how the theoretically predicted problems individually or collectively affected the effectiveness and/or efficiency of a transaction.

This section is structured as follows. In a first step I elaborate on the outcomes to be explained, i.e. the effectiveness and efficiency of transactions, and discuss how these concepts are measured in this study. In a second step I specify the explanatory variables of the analytical framework, i.e. the problems in designing and implementing positive incentives.

Measuring the Effectiveness and Efficiency of Transactions

The effectiveness of a transaction denotes the extent to which positive incentives drove the recipient country's behavior in a direction desired by the provider state. In other words, the degree to which the employment of positive incentives—and this cooperation strategy exclusively—altered the behavior of the recipient and hence reduced the negative externality at hand determines the effectiveness of a transaction. The efficiency of a transaction denotes the cost-effectiveness of positive incentives in driving the recipient country's behavior in a direction desired by the provider state. The concept of efficiency used in this study

encompasses two related, nevertheless distinct dimensions. The first dimension of efficiency relates to the question of whether the employment of cooperation strategies other than positive incentives could have led to comparable or superior externality-reducing behavioral changes on the part of the recipient country at a lower or comparable cost. If no other alternative cooperation strategy could have generated larger net-benefits (benefits minus costs) arising from the behavioral changes on the part of the recipient, then the employment of positive incentives can be considered to have been efficient. The second dimension of efficiency relates to the question of whether alternative ways of employing positive incentives—i.e. the funding and implementation of alternative capacity-building measures—could have led to comparable or superior externality-reducing behavioral changes on the part of the recipient country at a lower or comparable cost. If this question can be answered in the negative, then the specific way the provider countries employed positive incentives can be considered to have been efficient.

It should be noted that the concepts of effectiveness and efficiency used in this study are not mutually dependent in the sense that when a transaction is found to be (in)effective, it necessarily has to be (in)efficient, or vice versa. For example, a transaction may be simultaneously effective and inefficient if the employment of positive incentives succeeded in reducing the negative externality at hand, but alternative cooperation strategies and/or ways of employing positive incentives could have led to comparable or superior externality-reducing behavioral changes on the part of the recipient country at a lower or comparable cost. Conversely, an ineffective but efficient transaction implies that the provision of positive incentives failed to alter the externality-generating behavior of the recipient country, but also that no other cooperation strategy and/or way of employing positive incentives could have led to a more favorable outcome from the point of view of the provider countries.

From the discussion above it follows that it is necessary to specify a set of alternative cooperation strategies as analytical benchmarks for assessing the effectiveness and efficiency (first dimension) of transactions. Indeed, in order to evaluate the effectiveness of a transaction, we need to control for the possible effects of other cooperation strategies that the provider countries may have employed in combination with positive incentives. Moreover, in order to evaluate the efficiency (first dimension) of a transaction, we need to determine whether the employment of other cooperation strategies could have generated larger net-benefits for the provider countries. Furthermore, it should be noted that in order to assess the second dimension of efficiency, it is necessary to specify the possible ways by which provider

countries can employ positive incentives to reduce or eliminate negative externalities. However, since the potentially available capacity-building measures to solve a transnational environmental problem are generally linked to the nature of the transnational environmental problem at hand, I have found it more practical to elaborate on these measures in a section of the subsequent chapter which provides an introduction to the physical and political basics of the nuclear safety problem in CEE and the FSU. Hence in the following I focus on establishing the analytical benchmarks for assessing the effectiveness and efficiency (first dimension) of transactions by specifying a set of alternative cooperation strategies.

So far I have discussed two cooperation strategies which states may adopt as alternative strategies to positive incentives: Issue-specific reciprocity and negative incentives. However, using these two cooperation strategies in this study as analytical benchmarks for assessing the effectiveness and efficiency of transactions would be inadequate for the following reasons. On the one hand, an analysis of the cost-effectiveness of issue-specific reciprocity would not produce any relevant results because issue-specific reciprocity could not have been usefully employed in the examined empirical cases. As already pointed out, issue-specific reciprocity is only then usefully employed when the issue-specific behavior of the victim state can influence the preferences of the perpetrator state. This condition is, however, not always given in international environmental affairs, and it certainly was not given in the context of the nuclear safety problem in CEE and the FSU. Indeed, it made no sense for the Western (victim) states to threaten to reduce the safety levels at their own nuclear power plants in order to entice the Eastern (perpetrator) states to improve safety levels at their nuclear power plants. Thus, for practical reasons I exclude issue-specific reciprocity from analysis. On the other hand, focusing exclusively on negative incentives to assess the effectiveness and efficiency of transactions would be inappropriate because I would thereby fail to take into account other available strategies that may be employed to foster international environmental cooperation.

As such it is clear that I must expand on the selection of alternative cooperation strategies in order to adequately assess the effectiveness and efficiency of transactions. Specifically, I include three additional alternative cooperation strategies for analysis. On the one hand, states may provide a different type of positive incentives, i.e. they may employ positive issue-linkage strategies. On the other hand, states may seek to foster international cooperation by providing new information or by altering existing norms and values, i.e. they may adopt what Mitchell (1997, 1999) has termed cognitive or normative strategies. In the

following I briefly outline the five cooperation strategies analyzed in this study. One word on terminology: What is referred to below as the *sender state* is the state employing a cooperation strategy. The state whose behavior the sender state attempts to alter by employing a cooperation strategy is referred to as the *target state*.

Positive incentive strategies involve transfers of positively valued resources, such as money, technology, or know-how, from a sender (provider) state to a target (recipient) state. The logic underlying positive incentive strategies is twofold: On the one hand, such strategies seek to alter the incentive structure of a target state by increasing the latter's perceived net-benefits of changing its behavior. On the other hand, such strategies seek to generate new opportunities for a target state to alter its externality-generating behavior if it lacks the capacities to do so. As such positive incentive strategies are based on the assumption that target states are reluctant and/or incapable of altering undesirable behaviors. Although dependent on reliable information regarding the target state's behavior, positive incentive strategies have the advantage of inducing target states to provide rather than hide information. Moreover, such strategies are generally regarded by target states to be less coercive and less of an infringement on sovereignty and free will. In recent years positive incentive strategies have been increasingly employed in international environmental affairs, in particular vis-à-vis capacity-poor countries of the developing world and the former socialist bloc. Notwithstanding their attractiveness and behavior-altering potential, positive incentive strategies may suffer from a number of problems. The problems involved in designing and implementing positive incentives are discussed in detail below.

Positive issue-linkage strategies constitute a related, nevertheless distinct category of positive incentive strategies. Indeed, while the latter involve the provision of material incentives within the issue-area currently under negotiation between the sender and target states, the former generate (positive) incentives by linking various non-related issues with each other. Positive issue-linkage strategies seek to make desirable behavior on the part of the target state more attractive by increasing the target state's perceived net-benefits of changing its behavior. For example, a sender state may hold out the prospect of improved market access or other economic benefits to a target state if it changes its undesirable behavior in the environmental realm. Such strategies are based on the assumption that target states are unwilling, but basically capable of altering their undesirable behaviors. Positive issue-linkage strategies tend to share most of the advantages and implementation problems of positive incentive strategies.

Negative incentive strategies involve sanctions, threats, coercion and other efforts designed to discourage undesirable behavior by increasing its costs (Mitchell 1999). Although negative incentive strategies are not often used in international environmental politics, they have been employed in some cases. Indeed, various powerful states, such as the United States, have on various occasions threatened violators of international environmental agreements with economic sanctions in order to induce these states to comply. For example, it is widely assumed that the blanket moratorium adopted by the International Whaling Commission in 1982 has been effective because the United States threatened to punish violators of the moratorium, in particular Japan, with economic sanctions (DeSombre 1994, 2000). Negative incentive strategies are based on the assumption that the target state prefers to engage in the undesirable behavior because it values that behavior more than available alternative behaviors and that the target state has adequate capacity to engage in desirable behaviors. Such strategies can suffer from a host of problems (see Pape 1997). While negative incentive strategies are dependent on reliable information regarding the target state's behavior, they tend to induce the target state to conceal or misrepresent information of its own behavior. Moreover, sanctions need to be credible and/or potent to be effective. However, the costs of sanctions and problems of collective action on the part of the sender states can prevent these conditions from being met. Furthermore, in some cases sanctions can lead to a so-called "rally around the flag" effect in the target state, thereby strengthening the target state's resolve to continue its undesirable behavior. It must also be taken into account that the benefits the target state perceives to gain from its undesirable behavior may be larger than the costs the target state reckons it would incur by enduring threatened sanctions. Finally, even if a negative incentive strategy succeeds in inducing a behavioral change on the part of the target state, in some cases sanctions will only lead to a short-term change of preferences and not to a genuine change of interest. When sanctions are lifted, the target state's preferences often revert to the status quo ante (Bernauer and Ruloff 1999).

In various real-world cases confusion may arise as to the precise distinction between negative incentive and positive issue-linkage strategies. Indeed, depending on the circumstances, a target state may consider an attempt by a sender state to link various issues to be a negative incentive or a positive issue-linkage strategy. Hence, in order to precisely differentiate between these two cooperation strategies in empirical cases, we need to pay careful attention to the status quo and existing expectations on the part of the target state (Mitchell and Keilbach 1999). Consider once again the example discussed above of two states

(A and B) sharing a lake both for drinking water and waste disposal purposes. Assume also that both states are engaged in a certain level of trade. State A is employing a negative incentive strategy if it attempts to increase B's level of pollution abatement by threatening to reduce levels of trade that B had previously expected would continue or to block increases in trade that B had previously expected would occur and promises to maintain previously expected trade levels or improvements only if B increases its level of pollution abatement. State A is employing a positive issue-linkage strategy if it attempts to increase B's level of pollution abatement by offering to increase trade with B beyond the level that B had previously expected only if B increases its level of pollution abatement.

Cognitive strategies attempt to furnish target states with new, more complete, or more accurate information with the aim of allowing target states to make more intelligent decisions which favor the behaviors sought by the sender states (Mitchell 1997). By informing target states of the costs and risks of their current behavior, cognitive strategies essentially attempt to convince target states that they are unwitting victims of their own behavior. For example, sender states can provide in-depth assessments of environmental problems in a target state in an attempt to convince the latter that remedial action would be in its own interest. Indeed, in one real-world case the countries participating in the LRTAP regime of the ECE provided the British government with compelling information on the full costs of its own externality-generating behavior, i.e. the costs not only accruing to other countries, but also to the United Kingdom. This measure was successful in persuading the British government to initiate a broad range of environmental measures that ultimately led to significantly reduced levels of acid rain in the whole region (Levy 1995). The underlying assumption of cognitive strategies is that the target state is basically both willing and capable of changing its behavior. In addition, cognitive strategies assume that the target state engages in undesirable behavior because it mistakenly believes it to be desirable or beneficial and that changes to the target state's perceived benefits and costs of existing alternatives through information will encourage it to adopt a desirable behavior. Providing information on the consequences and opportunities of various behavioral options represents a cost-effective strategy to induce behavioral change. However, it should be noted that these strategies will be ineffective when sender states adhere to them as a cheap way "to do something" rather than because inadequate information on the part of the target state is known to be the source of the undesirable behavior (Mitchell 1999).

Normative strategies are designed to influence the behavior of target states by altering deep-seated values and norms. In contrast to cognitive strategies, normative strategies do not merely seek to induce target states to adopt new means to pre-existing goals, but rather attempt to persuade target states to embrace new goals. For example, during negotiations and recurring meetings, sender states may try to convince target states to accept their norms of behavior, or both sender and target states may collaborate to focus attention on a particular problem, create new norms, and increase their respective commitment to such norms (Mitchell 1997). Normative strategies assume that target states are principally capable of adopting desirable behaviors and that they will do so once their norms and values have been altered through normative dialogue and education. International efforts aimed at altering norms are, however, often regarded by target states as presumptuous or even imperialist, and may thus provoke strong resistance on the part of target states. In addition, rhetorical attempts aimed at persuading target states to alter deeply held norms often take considerable time, and hence may be an unsuitable strategy for addressing urgent transnational environmental problems. On the other hand, if successfully employed, normative strategies are likely to induce wider ranging, deeper, and more stable behavioral changes at a relatively low cost than most alternative cooperation strategies (Mitchell 1999).

In sum, the four alternative cooperation strategies outlined above—positive issue linkage, negative incentive, normative and cognitive strategies—provide the analytical benchmarks for assessing the effectiveness and efficiency (first dimension) of transactions. The effectiveness of a transaction can be more appropriately evaluated by controlling for the effect the parallel employment of one or more of these alternative cooperation strategies may have had on the behavioral changes of the target state. In addition, the efficiency of a transaction (first dimension) is assessed by comparing the relative costs and benefits of positive incentives with those of the four alternative cooperation strategies. The five cooperation strategies analyzed in this study are summarized in the table below.

TABLE 2.1: SET OF COOPERATION STRATEGIES

Cooperation Strategies	**Main Elements of Strategies**
Positive Incentive Strategies	Such strategies involve the transfer of positively valued resources within an issue-area and attempt to increase both the target state's incentives and capacities to cooperate. The target state's incentives to cooperate are enhanced by increasing its perceived net-benefits of cooperation.
Positive Issue-Linkage Strategies	Such strategies seek to generate (positive) incentives by linking various non-related issues with each other. The target state's incentives to

	cooperate are enhanced by increasing its perceived net-benefits of cooperation.
Negative Incentive Strategies	Such strategies encompass all kinds of sanctions and threats. The target state's incentives to cooperate are enhanced by increasing its perceived costs of non-cooperation.
Cognitive Strategies	Such strategies attempt to induce target states to cooperate by providing them with information on the full costs and risks of their own behavior which not only other states, but they themselves bear.
Normative Strategies	Such strategies seek to induce target states to cooperate by altering the values, and hence, the policy goals of target states. They rely on persuasion and operate by means of dialogue and education.

Problems in Designing and Implementing Positive Incentives

As pointed out above, the explanatory concepts of the basic analytical framework are operationalized in terms of problems that arise when designing and implementing positive incentives and that may affect the effectiveness and/or efficiency of a transaction. These problems, which are derived from game theory, negotiation analysis, economic theories and International Relations theory in general and build upon the results of empirical research on incentives in various areas of international relations, are specified below.

Properties and Processes of Interaction between Donor and Recipient Countries

Extortion: Both the effectiveness and efficiency of transactions can suffer from problems of "extortion". Extortion is defined in this study as a behavioral strategy by which one actor misleads other actors into paying it to refrain from adopting some externality-generating or externality-enhancing behavior which it would not have adopted regardless of whether such a payment materialized or not. Extortion can thus arise when information on the (future) preferences and behavior of actors is unevenly distributed. For example: State A threatens to enhance a negative externality (for example increasing the production of ozone-depleting chemicals) unless other countries provide a specific amount of resources. The other countries are uncertain whether state A will carry out its threat if they refuse to comply with state A's payment demand, i.e. state A can capitalize on private information which the other countries do not have. Even if state A was aware that enhancing the negative externality would be costly to itself as well and therefore would have not delivered on its threat regardless of the outcome of its payment demand, but the other countries did not know this for sure, the other countries might still have complied with state A's payment demand. If successful, extortion

misleads donors into offering "money for nothing": The donor countries paid state A to refrain from adopting a harmful behavior although state A would have refrained from doing so even in the event of no payment. Hence, in this specific case the resource transfer was inefficient in driving the behavior of state A in a direction desired by the other countries.

Moral Hazard: A further problem that can hamper both the effectiveness and efficiency of transactions aimed at solving transnational environmental problems is moral hazard behavior on the part of the recipient country. Moral hazard has been coined in the literature on insurance economics and refers to the phenomenon that actors tend to engage in risky activities when they have reason to believe that others will bail them out if they run into serious troubles. With respect to international environmental politics, the prospect of environmental assistance may induce a potential recipient country to behave in similar ways. For example: The prospect of international environmental assistance may induce a country to postpone already earmarked domestic investments in environmental protection measures and to generally accept higher levels of environmental risk than it would otherwise be willing to live with precisely because it hopes or expects that other countries will provide the necessary resources to reduce the risks associated with its behavior to an acceptable level. Thus, in this specific case the donors paid too much for what they received in terms of environmental benefits: If the recipient country could not have expected that other countries would intervene and provide environmental assistance, it would have been less willing to engage in risky activities in the first place or it may have invested its own resources to reduce the environmental risk.

So far I have outlined the potential impact of extortion and moral hazard on the efficiency (first dimension) of transactions. However, also the effectiveness of transactions can suffer from these two problems. This relates in particular to the risk that fear of extortion and moral hazard problems may deter donor states from engaging in otherwise mutually beneficial transactions. Indeed, the risks of extortion and moral hazard have been frequently cited in public debates as the most important arguments against the provision of positive incentives as a means to foster international cooperation. In fact, donor states may become so concerned about the problems of extortion and moral hazard that a "hazard of moral hazard" (Bernauer and Ruloff 1999: 30) may arise, thereby precluding transactions aimed at solving international externality problems. However, the occurrence of such risks in real-world cases may be far less pronounced than widely assumed. In addition, it should be noted that there are clear limits to extortion and moral hazard that may serve to reassure donor states that such

risks are low. To begin with, both extortion and moral hazard will occur only under certain conditions. In order for a country to extort resources from other countries, its threat to engage in some externality-generating or externality-enhancing behavior that it itself is not genuinely interested in has to be credible. If the potential costs to the extorting country obviously exceed any gains it could hope to achieve, then its threat will not be perceived as credible. Its threat will also be dismissed as incredible when the extorting country is perceived as lacking the capacity to generate or enhance a negative externality. Hence, economic conditions, technical constraints, domestic political exigencies, or organizational inertia can render many externality-generating behaviors unattractive or even unattainable for those countries threatening to engage in them. Moreover, both extortion and moral hazard are unlikely to occur when the externality threatened or generated by a country hoping to obtain positive incentives from others does not harm any country that has the capacity to provide positive incentives.

Furthermore, states also have various means at their disposal to reduce the risks of extortion and moral hazard behavior. For example, donor states can prevent the most obvious extortion attempts by using positive incentives exclusively in order to compel recipients to engage in desirable behavior rather than to deter recipients from engaging in undesirable behavior. This argument is based on the following reasoning. Extortion risks emanate from two types of states: From those states currently engaged in a desirable behavior which threaten to adopt some new undesirable behavior unless rewarded, and from those states currently engaged in an undesirable behavior which threaten to continue or intensify that behavior unless rewarded for not doing so. Extortion attempts by the former type of state can be prevented by strictly restricting resource transfers to those states engaged in the undesirable behavior at or prior to the time the donor states adopted a strategy of positive incentives (Mitchell 1998). Donor states can also safeguard against such risks by implementing measures that increase their information of the recipients' preferences (extortion being dependent on incomplete information). A strategy of cooperation in steps involving intensive monitoring allows donor states to withdraw from an exchange if they suspect extortion or moral hazard. Finally, donor states can reduce the likelihood of extortion and moral hazard by insisting that recipient states contribute financially or in-kind to the common purpose. Such joint-financing of activities creates burdens also for the recipients, thereby reducing their incentives to engage in extortion and moral hazard. In short, although

extortion and moral hazard may pose serious problems in transactions, they can—at least in principle—be managed.

Information and distribution problems: Two problems that typically arise when negotiating exchanges and that may negatively affect the effectiveness of transactions pertain to information and distributional issues. Both problems are related. Information problems derive from the fact that actors have incomplete information about each other's future preferences and behavior. Distribution problems arise because each actor—assuming that actors behave as utility maximizers—has an interest in contributing as little as possible to the common purpose and securing the greatest possible benefit. In other words, those countries providing resources will seek to obtain the maximum amount of environmental protection measures from the recipient countries for as few resources as possible. The recipient countries, on the other hand, will attempt to gain the maximum amount of resources from the donors and deliver as few environmental protection measures as possible. In such situations, actors often seek to manipulate information they provide to others in order to maximize their net-benefits from a joint effort, for example by exaggerating the costs and understating the benefits of solutions proposed by other actors. Strategic manipulation of information on the costs and benefits of solutions under negotiation may lead to a "stingy" bargaining behavior of the parties and to protracted negotiations in which each side is holding out for more (Bernauer and Ruloff 1999).

Information problems also arise because actors often have incomplete scientific information on the exact price and value of the specific object under negotiation. For example, in some instances it is virtually impossible to determine in advance how much specific environmental protection measures will cost. Furthermore, those countries providing resources have to determine how much they are both individually and collectively willing to pay for an improved environment. For example, it can be assumed that—ceteris paribus—individual contributions to a solution of a transnational environmental problem will correspond to the specific degree of exposure of the individual countries to the environmental problem. However, in many instances it is simply not possible to evaluate in monetary terms the costs or risks of a negative externality affecting a country. Nor will it be easy for donor states to put a collective price tag on an improved environment since there are no reference prices for such a good. Consequently, negotiating parties will often experience great difficulties in determining which country should provide which amount of resources in what time frame in exchange for what kind of environmental protection measures.

Enforcement problems: When providing resources in exchange for externality-reducing behavioral changes on the part of the recipient countries, donor states tend to hope that the recipients' concerns for their reputations will provide sufficiently large incentives to comply with agreed upon environmental protection measures or other commitments. However, in many cases vague concerns about reputation costs will not suffice to secure compliance. Moreover, specific mechanisms aimed at protecting donors against reneging or non-compliance by recipients, such as cooperation step-by-step or the use of hostages, may not be available under certain circumstances (Keohane 1984). Thus donor states may have to adopt stronger enforcement mechanisms. However, enforcing international agreements beyond the specific measures mentioned above—such as cooperation in steps or the use of hostages—is often hampered by problems that arise in employing negative incentives such as economic sanctions.

Various analysts have pointed to a host of factors that may undermine the effectiveness of sanctions in driving the recipient's behavior in a direction desired by the sanctioning states (Hufbauer and Schott 1990; Pape 1997). I limit the discussion of these factors to two major problems involved in employing negative incentives in international environmental politics. First, it must be taken into account that the most serious transnational environmental problems originate in capacity-poor countries. Punishing a capacity-poor recipient country with sanctions in order to enforce compliance with an international environmental agreement may be opposed both on normative grounds and because this country may simply be unable to change its behavior in the direction requested by the sanctioning side. Indeed, in most cases of international environmental politics the rationale behind the provision of positive incentives is to help capacity-poor states to comply with international agreements. Punishing such states for non-compliance is therefore likely to be perceived as both unfair and ineffective and may even drive such states over the brink. Second, sanctions often impose considerable costs—both in economic and political terms—on the sanctioning states as well. Indeed, economic sanctions usually impose concentrated costs on some groups of the sender state's domestic constituency to provide diffuse social benefits should the sanctions work. Those domestic groups bearing the costs of the sanctions are likely to oppose the sanctions and lobby against their implementation (Olson 1965). Moreover, sanctions imposed to enforce compliance with an international environment agreement may also hurt broader economic or political interests of sender states, thereby reducing the likelihood that this policy tool will be used. For example, if sender states have a

strong strategic interest in the economic and political stability of a potential target state, and if sanctions against this state run the risk of undermining this strategic interest, then sanctions are unlikely to be imposed. In short, the effectiveness of transactions can be seriously undermined by enforcement problems.

Processes of Interaction in Donor and Recipient Countries

Problem-Definition: It has been argued above that insufficient capacities are often a major reason why countries engage in externality-generating behavior and that resource transfers are an important means to solve transnational environmental problems that result from insufficient capacities. Moreover, it has been suggested that donor countries can employ their resources in different ways to address insufficient capacities on the part of recipient countries. In other words, donor countries often have a choice to fund and implement different capacity-building measures in recipient countries. However, not all capacity-building measures are equally cost-effective in driving the behavior of the recipient in a direction desired by the donor countries. For example, the funding and implementation of one particular measure may enable the recipient to change its externality-generating behavior at lower cost, or more durably at comparable cost, than other available measures. Which capacity-building measures donors chose to fund and implement is determined by what is referred to here as problem-definition, i.e. the specific way donors define an environmental problem (Keohane and Levy 1996). As such it is evident that problem-definition has important implications for the efficiency (second dimension) of a transaction.

The specific interests of donor governments and domestic producer groups often determine how an environmental problem is defined and consequently which specific solutions to a transnational environmental problem are selected for implementation. Especially then when the public benefits to be gained from addressing a transnational environmental problem are not substantial, donor governments—provided that they are willing to transfer resources—will tend to prefer solutions that also provide private benefits. Indeed, the widespread practice of donor states tying environmental and other aid programs to the purchase of technology and services from domestic firms testifies to this general preference. Nevertheless, even when considering that resource transfers are often designed to generate private benefits for donor countries, donor governments may still have a choice among different ways to employ their resources. Thus, to understand why and when donor governments may favor some solutions over others, we must also take into account the

interests and political clout of domestic producer groups. When domestic producer groups believe that they can derive concentrated benefits from particular solutions to a transnational environmental problem, they will seek to lobby the government into adopting their preferred solutions and providing the necessary resources. The outcome of the interest group process is of course difficult to predict, but we can hypothesize that the government will tend to favor those solutions which are consistent with its own policy goals and which are preferred by the domestic producer group with the largest political clout (Meier 1988). Needless to say, the solutions that serve the interests of a specific domestic producer group need not represent the most cost-effective way to address a transnational environmental problem.

"*Slippery slope effect*": A problem that may seriously hamper the effectiveness of a transaction relates to what Connolly and List (1996) have dubbed the "slippery slope effect". As noted above, states often engage in undesirable, externality-generating behavior because they have insufficient capacities to adopt new, desirable behaviors. Capacity-building measures funded by donor states are designed to enable the recipient to renounce its previous undesirable behavior and engage in new desirable behavior. However, the effectiveness of such resource transfers often depends on how easily the recipient can simultaneously engage in both the previous undesirable and new desirable behavior. Unless the two behaviors are mutually exclusive, recipient states may adopt new desirable behaviors but continue undesirable ones, thereby reducing the overall effectiveness of the resource transfer. Under such circumstances, the resource transfer will only be effective if the donor states can make the resource transfer contingent on the recipient both adopting a desirable behavior and refraining from engaging in undesirable behavior (Mitchell 1998).

The following example serves to illuminate what the "slippery slope effect" implies. Transnational environmental problems are often caused by the operation of "dirty" or unsafe industries, for example power plants that use inefficient and antiquated technologies. In some cases, capacity-poor countries are economically highly dependent on the output of these power plants and therefore cannot afford to close them down immediately. Donor countries may thus agree to provide financial and technical assistance to modernize these power plants to allow them to operate at higher efficiency or safety levels for a specified period of time until they are definitively closed. However, once these power plants are modernized, the recipient country will have even less incentive to shut them down. What's more, while a modernized power plant may be cleaner or safer than it was before, it will certainly not be as clean or safe as it would be if it were closed altogether (Darst 1997). Thus in the example

above the “slippery slope effect” relates to the risk that the provision of resources may unintentionally result in prolonging the lifetime of a dirty or unsafe power plant, or put in other words, in encouraging and enabling the recipient to continue its previous undesirable behavior.

Coordination problems: If more than two countries are involved in a transaction, cooperation problems may arise on the donor and recipient side, respectively. An important factor that can give rise to cooperation problems on the donor side pertains to the specific nature of the benefits donors expect to gain from addressing an environmental problem. In the case of public benefits, the donor countries may have to cope with burden-sharing problems, i.e. disputes over which donor should provide which amount of resources and why. Burden-sharing problems can seriously hamper the effectiveness of a transaction since such problems may lead to a sub-optimal provision of resources needed for the common purpose. Thus in order to secure both an adequate provision of resources and the cohesion of the donor group, donors may have to take safeguard-measures against “free-riders“. Making the potential beneficiaries pay their share for the provision of a public good, however, involves enforcement problems, not between donor and recipient countries, but within the donor group.

If the benefits to be gained from addressing an environmental problem are predominantly of a private nature, then a competition for these private benefits may break out in the donor group. Such a competition for private benefits within the donor group can have the effect of undermining any attempt to establish a united donor front vis-à-vis a recipient country. As a result, the recipient country can play donors against each other and effectively circumvent the conditions donors may try to impose on their environmental aid programs. One possible strategy to secure a united donor front in the face of donor competition for private benefits is to persuade the various donor countries to pool their resources under the custody of an international funding agency. By distributing private benefits in relation to the resources provided by the individual donor countries, such an agency may be able to defuse donor competition for private benefits and hence may be better placed than individual donors to pursue conditionality policies.

When there is more than one recipient involved in a transaction, similar problems can also arise on the recipient side. A potential cooperation problem on the part of the recipients relates to the situation in which recipients have to compete for the resources provided by the donors. From the donors’ perspective, such a situation is advantageous since it may induce the recipients to deliver the maximum amount of environmental protection measures at the lowest

price. Whether or not donors can place various recipient countries into competition with each other depends upon the possibilities to substitute environmental measures by one recipient country for environmental measures by another. In case the cooperation of all potential recipient countries is vital for the desired outcome, i.e. in so-called weakest-link situations (Sandler 1994), then placing recipients into direct competition will fail to be effective. Theoretically, recipients can avoid such a competitive situation by coordinating their bargaining positions vis-à-vis donor countries, i.e. they could attempt to collude in order to coordinate positions on which amount of environmental measures recipients are willing to offer for what price. However, experience shows that such action is rare.

In sum, the basic analytical framework outlined above focuses our attention on eight distinct problems that can arise when designing and implementing positive incentives. Whether they in fact arise in specific empirical cases and the extent to which they can be resolved through the mechanisms discussed, influences the effectiveness and/or efficiency of transactions. The principal problems in bringing positive incentives to bear and the specific outcomes they affect are summarized in the table below.

TABLE 2.2: PRINCIPAL PROBLEMS OF POSITIVE INCENTIVES

Problem	**Affected Outcome(s)**
Extortion	Efficiency (first dimension) Effectiveness
Moral Hazard	Efficiency (first dimension) Effectiveness
Information Problems	Effectiveness
Distribution Problems	Effectiveness
Enforcement Problems	Effectiveness
Problem-Definition	Efficiency (second dimension)
“Slippery Slope Effect”	Effectiveness
Coordination Problems	Effectiveness

"It's impossible to deliver [our nuclear] power stations by missile to some other country, but in reality, they are no less dangerous than nuclear weapons."

- Alexei Yablokov, environmental adviser to the former Russian President Boris Yeltsin, 1992 (Halverson 1993: 43).

3 THE NUCLEAR SAFETY PROBLEM IN CEE AND THE FSU

Although it may be far-fetched to equate the dangers posed by nuclear weapons with the threat emanating from the continued operation of Soviet-built nuclear power plants (NPPs), the introductory quotation above certainly serves to illustrate the potentially grave transboundary consequences of a serious accident at one of the 58 operational nuclear reactors in CEE and the FSU. This alarming judgment was underscored by the dramatic and still fresh memories of the worst accident in the history of the civilian use of nuclear power: On 26 April 1986, block 4 of the Chernobyl NPP in Ukraine exploded due to sudden and uncontrollable increases in power which led to catastrophic releases of radioactive material into the environment.[1] The number of casualties directly related to the accident is officially put at 31, with an unknown number of Chernobyl victims in Ukraine, Belarus and Russia currently still suffering from long-term health problems.[2] Within weeks after the nuclear accident around 116'000 people had to be evacuated from the towns and villages within a radius of 30 kilometers of the plant, and since then more than 200'000 have been removed from their homes due to long-term radiation exposure. In total some 28'000 square kilometers of land in Ukraine, Belarus and Russia were contaminated with caesium-137 and an area of around 3'000 square kilometers is considered to be so seriously contaminated that it will

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[1] The Chernobyl accident occurred after plant operators conducted a series of maneuvers as part of a test to see how the reactor would respond to freak power surges, a phenomenon to which this particular reactor type is known to be susceptible. Although inherent design deficiencies of the Chernobyl reactor were certainly a determining factor of the catastrophe, the Soviet authorities blamed the accident exclusively on operator error in an attempt to shield their nuclear technology against any criticism and to allay fears that such an accident could ever occur again (Connolly 1997: 78; Foss 1999: 25).

[2] There have been wild speculations regarding the death toll of the Chernobyl catastrophe. On the eve of the 9th anniversary of the accident international media reports claimed that 125'000 people had died in Ukraine as a result of long-term radioactive contamination. In 1996 the Ukrainian Deputy Health Minister put the number of Chernobyl casualties at 1'800, especially among the 600'000 "liquidators" which had been involved in clean-up operations immediately after the accident. However, there is presently no international consensus on the exact death toll, and the only confirmed health effects of the accident are the well-known epidemic of childhood leukemia and a pronounced increase in suicides among the liquidators (NucNet, 21 February 1996; NW, 29 April 1999: 1, 12).

remain inhabitable for decades (Herttrich et al. 1994: 89; Perera 1997b). The damage was, furthermore, not confined to the plant's immediate vicinity: As a consequence of then prevailing meteorological conditions, the radioactive fallout was dispersed over large regions of Scandinavia and Western Europe. The radioactive cloud contaminated agriculture, exposed the populations of various Western countries to sharply elevated levels of radiation and caused millions of dollars of damage. The nuclear disaster at Chernobyl thus clearly demonstrated that the risks connected with the production of nuclear power were a transnational problem, and as such a matter for international politics.

Although the 1986 Chernobyl disaster had raised international concern about nuclear safety in CEE and the then existing Soviet Union, knowledge of Soviet-designed reactors was rather limited at the time. Moreover, the international community could not do much about the problem due to Soviet intransigence to cooperate on such a sensible issue during the Cold War. Four years later, however, the revolutions that swept across Eastern Europe in 1989/90 and the demise of the Soviet Union in late 1991 created new opportunities for concerned Western countries to address the nuclear safety problem in the East. Starting in September 1990, the International Atomic Energy Agency (IAEA) launched a series of fact-finding missions to various Eastern NPPs. These missions revealed that the nuclear safety problem in CEE and the FSU was far worse than anticipated and that another Chernobyl-type nuclear disaster could occur unless urgent action was taken.

The following chapter describes the physical and political basics of the nuclear safety problem in CEE and the FSU with the aim of providing relevant background information to the individual case studies. This chapter is structured along the following lines. The first section elaborates on the concept of nuclear safety and provides a basic understanding of the factors that account for the serious safety shortcomings of Soviet-built NPPs. The second section discusses the interests of the principal actors involved in the international attempt to improve nuclear safety in CEE and the FSU, i.e. the interests of both Western and Eastern governments and the Western nuclear industry. This section shows that there were competing interests not only between Western and Eastern governments, but also among the Western donors. The third section explores the various cooperation strategies and capacity-building measures by which the Western countries could address the nuclear safety problem. This section explains why the Western donors sought to solicit nuclear safety cooperation from the Eastern governments by predominantly pursuing positive incentive strategies and elaborates on a range of ways by which the Western donors could employ positive incentives. In doing

so, this section also provides a set of analytical benchmarks against which the efficiency of positive incentives (second dimension) may be assessed in the individual case studies. The fourth and final section of this chapter elaborates on the West's initial response to the nuclear safety problem. This section includes a brief description of the international institutional context in which the West began to address the nuclear safety problem in CEE and the FSU and presents a rough outline of the West's major nuclear safety assistance programs.

3.1 Safety Deficiencies at Eastern NPPs

International experts have defined *nuclear safety* since the 1980s as "the achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in the protection of site personnel, the public and the environment from undue radiation hazards" (Foss 1999: 33). During the past two decades an international consensus on nuclear safety has evolved according to which the level of nuclear safety is determined by three basic features:

- The design of nuclear reactors and other technological aspects at nuclear facilities
- The quality of their manufacture, maintenance and manning, i.e. operational safety aspects or a so-called "safety culture"
- A proper regulatory framework and licensing procedure

This concept of nuclear safety took several decades to develop in Western countries, and was until recently largely absent in the countries of the former socialist bloc. In the early days of the commercial use of nuclear energy, nuclear safety was geared not to the prevention of nuclear accidents, but rather to the protection of workers and the public from the exposure to ionizing radiation. Only in the late 1970s did nuclear safety concepts in the West begin to shift towards accident mitigation and containment (Connolly 1997: 158). The approach initially taken by Western countries was a technical one that largely applied to design aspects of nuclear facilities. This approach resulted in the adoption of the concept of defense-in-depth, whereby nuclear facilities are constructed with a high degree of redundancy and with layers of back-up measures capable of compensating for the potential failure of any given safety response such as shutdown systems and containment structures (Foss 1999: 33).

Following the 1979 accident at the Three Miles Island NPP in the United States, this technical approach to nuclear safety was regarded as insufficient to guarantee the safe

operation of nuclear plants. As a result, increased attention was devoted to operational aspects of nuclear power generation, especially to those related to human behavior. These efforts have not only led to improvements in training, maintenance and quality assurance, but have cumulated in the understanding that a general attitude of caution is required to avoid accidents. Thus, when both managers and workers of a nuclear facility display an instinctive attitude of conservatism with regard to safety and assign priority to safety over all other operational goals, a so-called "safety culture" is considered to be in place. Finally, over the past decades there has grown an appreciation that an independent regulatory agency is an important prerequisite for the safe and responsible use of nuclear power. The primary function of such agencies is to regulate NPPs in the public interest and to ensure high safety standards by means of a legally-based licensing process. Essentially, regulatory agencies aim to protect the interests of the population against the organs of the state or powerful vested interests. Their independent status is designed to allow the regulatory agencies to be objective both in their judgments and in the execution of their duties.

A number of the technical and operational safety standards originally developed in Western countries were gradually adopted by the IAEA. Indeed, although the IAEA has primarily been concerned with non-proliferation issues, the agency has established a considerable body of safety norms and technical guidance for the civilian use of nuclear power, however without the authority to enforce safety standards. Beginning in the mid 1970s, the IAEA developed a series of codes and guidelines—known as the Nuclear Safety Standards Program (NUSS)—for the design and operation of NPPs. Furthermore, in 1988 the IAEA's International Nuclear Safety Advisory Group (INSAG) published a report which sets specific safety targets for nuclear reactors to achieve (Frogatt 1999). The NUSS standards and related IAEA documents such as the INSAG report have served as de facto international safety standards by which Western nuclear safety experts have judged the safety of Soviet-designed nuclear reactors. However, it should be noted that these international standards represent little more than the least common denominator of pre-existing nuclear safety standards in the West, and no country has a legal obligation to apply them to their nuclear facilities. The NPPs operating in the countries of CEE and the FSU have been found by Western nuclear safety experts to be deficient in all three safety-relevant aspects outlined above. In the following the major safety deficiencies of Eastern NPPs are briefly discussed.

Soviet-built nuclear reactors are essentially variations on two basic designs: The RBMK (graphite moderated channel reactor) and the VVER (pressurized water reactor).[3] Both reactor types were developed by the Soviets in multiple generations and vary considerably in safety levels. The RBMK reactor, a design that has never been used in the West, was developed by the Soviet Union not least for military purposes because it produces weapons-grade fissile material. Due to the possibility of military use, RBMK reactors were not exported beyond the borders of the then existing Soviet Union (Herttrich et al. 1994: 89; Launer and Young 1997: 54). However, following the breakup of the Soviet Union in late 1991 three new independent states inherited the 15 former Soviet RBMK reactors—Russia (11 operational reactors at the Leningrad, Smolensk and Kursk NPPs), Ukraine (two operational reactors at the Chernobyl NPP) and Lithuania (two operational reactors at the Ignalina NPP). The basic design flaws of RBMK reactors are outlined below (EBRD 1996: 6):

- Positive void reactivity coefficient (i.e. a potential for rapid and uncontrollable power surges)
- Complicated information and control system
- Insufficient diversity of neutron flux instrumentation and shutdown systems
- Lack of containment
- Limited capacity and poor redundancy of emergency core cooling systems
- Risk of single or even multiple channel rupture in case of insufficient coolant flow
- Insufficient fire protection
- Poor redundancy and shortcomings in emergency power supply

Although the Soviet authorities had introduced a number of technical safety improvements at various RBMKs in the wake of the 1986 Chernobyl accident, Western nuclear safety experts concluded in the early 1990s that these reactors were inherently unstable and could not be improved, even through extensive upgrading, to safety levels acceptable for long-term operation. Western nuclear safety experts therefore strongly recommended that the RMBK reactors be shut down as soon as possible.

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[3] RBMK stands for *Reaktor Bolschoi Moshnosti Kipyashchiy*. VVER stands for *Vodo Vodyanoy Energeticheskiy Reaktor* (Scott et. al. 1995: 703).

The VVERs are pressurized water reactors (PWRs), similar in their basic design to Western PWR reactors. The Soviet Union developed three generations of VVERs. The first generation of VVER reactors—built prior to 1970—is the VVER-440/230. At the time the West began to address the nuclear safety problem in the East, there were ten VVER-230s operating in the region: Two in the Slovak Republic (at the Bohunice NPP), four in Bulgaria (at the Kozloduy NPP) and four in Russia (two each at the Kola and Novovoronezh NPPs).[4] The safety of VVER-230s is hampered by the following design flaws (EBRD 1996: 6):

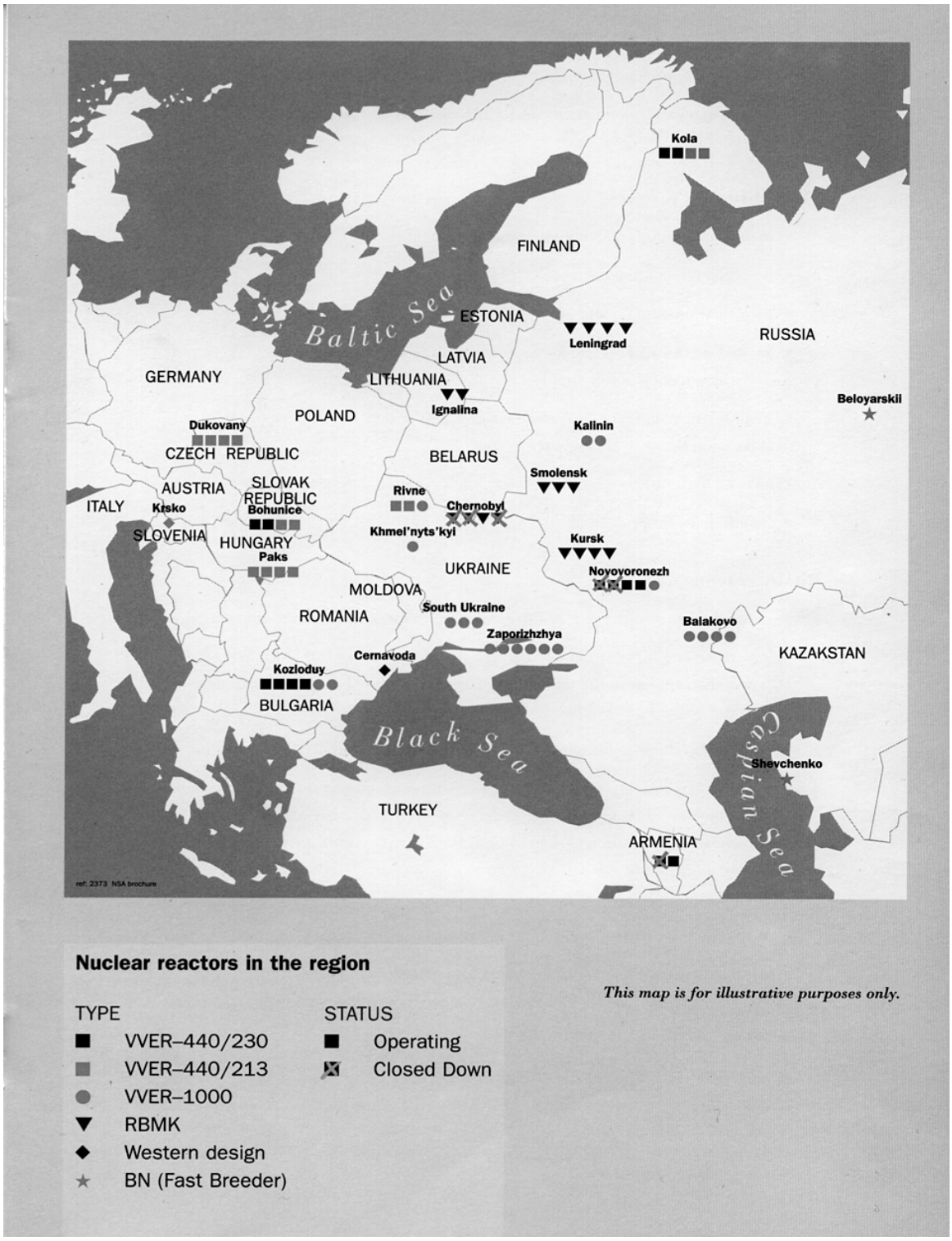
- Insufficient quality of equipment
- Insufficient containment
- Poor instrumentation and control
- Limited capacity of the emergency core cooling systems and of the emergency power supply
- Insufficient redundancy of safety systems
- Insufficient fire protection

Western nuclear safety experts concluded in the early 1990s that the VVER-230s were not upgradeable to internationally accepted safety standards, either for reasons inherent in their design or because the required upgrading could not be justified on economic grounds. They thus recommended that the VVER-230 reactors be shut down as soon as feasible. The second generation of Soviet-built PWRs, the VVER-440/213, was developed between 1970 and 1980 and incorporated several safety improvements on the earlier model, in particular a kind of containment structure. Although there are still legitimate concerns about the safety of the 14 operational VVER-213s, the IAEA concluded that they could be upgraded to fit international safety standards (Halverson 1993: 44). The most modern generation of the Soviet-built VVERs is the VVER-1000. The IAEA has stated that the VVER-1000 design "is similar to that of non-Soviet plants in operation worldwide and includes a full containment structure. However, some concerns related to design and operational problems remain, even for the more advanced 1000 MW units, mainly about core safety and instrumentation and control" (IAEA 1992: 6). Most Western nuclear safety experts opined that the 20 operational VVER-

[4] In 1995 the Armenian government decided to reopen a VVER-230 reactor at the Medzamor NPP that had been closed in 1989 due to concerns about seismic risks.

1000s had a design safety basis sufficiently comparable to that used in the West to justify safety upgrades on both safety and economic grounds.

FIGURE 3.1: GEOGRAPHICAL LOCATION OF THE 58 OPERATIONAL SOVIET-DESIGNED NUCLEAR REACTORS IN CEE AND THE FSU



Source: EBRD 1996: 5.

Besides the design flaws, a number of operational safety deficiencies that carry across all reactor types exacerbated the nuclear safety problem. Considering that in the past the operation of Soviet-designed nuclear reactors had been geared towards the achievement of maximum power output, with safety considerations far from being a top priority, it was not surprising that both staff and management of these plants lacked a proper "safety culture". Authoritarian and compartmentalized management styles were firmly entrenched at Eastern NPPs, with decisions frequently made at the national level. Operating staff were not encouraged to question or criticize, and therefore exhibited little curiosity about anything outside their immediate responsibilities. Moreover, areas such as staff training, in-service inspection and periodical testing, quality assurance, waste management, radioactive release and environmental monitoring, emergency planning for handling potential accidents, as well as documentation management and reporting procedures, were often poorly or inadequately developed (EBRD 1996: 4).

Although the operational safety problems outlined above existed well before Western nuclear safety experts had gained access to Eastern NPPs, the profound and far-reaching social, political and economic changes following the revolutions of 1989/90 in CEE and the dissolution of the Soviet Union in late 1991 aggravated the safety situation. Serious safety problems were created as Russian nuclear experts left the former socialist countries of CEE and the newly independent republics. Indeed, due to varying degrees of dependence on the Soviet Union for the supply of nuclear technology, nuclear fuel and the handling of spent fuel, nuclear safety in almost all countries of the region was negatively affected by the pullout of Russian technicians. At one extreme, Bulgaria and Lithuania were left to continue the operation of their NPPs without adequate operating manuals and experience (Connolly and List 1996: 237-238). In addition, the subsequent economic crisis related to these countries' transformation process added to the operational safety problems by demoralizing plant personnel—wages were cut or not even paid—and by leading to poor maintenance and repair work at Eastern NPPs (FT, 3 July 1992).

Finally, all CEE and FSU countries lacked a strong and independent nuclear safety authority capable of implementing and enforcing acceptable safety standards. Historically, nuclear regulation had always been weak in the former communist countries, although some differences existed. While various CEE countries had introduced a certain degree of nuclear regulation during the late 1970s and 1980s, the regulatory situation in the Soviet Union was far worse, where the industry and its colossal bureaucracy operated beyond the control of any

legal framework (Foss 1999: 58). The fact that prior to the Chernobyl catastrophe the Soviet authorities had been able to conceal from the public at least five other severe nuclear accidents involving fatalities and significant radioactive releases testifies to this deplorable state of affairs. The collapse of the Soviet Union in late 1991 did not necessarily improve the situation. All successor states of the FSU had to cope with the formidable task of developing from scratch their own organizations for the regulation of NPPs and other nuclear facilities that they had inherited. In addition, once these regulatory agencies were established, their influence and independence remained limited: In the early 1990s the nuclear regulatory agencies in nearly all CEE and FSU countries were understaffed and overworked, and most were clearly powerless vis-à-vis the richer and more influential facility operators (NW, 9 December 1993: 7).

In sum, due to a combination of various design deficiencies, an inadequate "safety culture", and the absence of a strong and independent regulatory framework, the risk of a serious accident at a Soviet-built NPP was found to be many times higher than at a Western NPP. The safety risk posed by the continued operation of these Soviet-designed nuclear reactors in the early 1990s is best illustrated by the judgment of William Martin, former head of the U.S. Department of Energy, who has argued that a nuclear accident could happen on average once every 180 reactor years for Soviet-designed reactors, unlike older Western reactors at which a serious mishap could occur once every 40'000 to 50'000 reactor years (Martin 1995: 74).

3.2 Interests of the Principal Actors

The shocking revelations of the IAEA fact-finding missions in the early 1990s and an alarming string of near disasters at Eastern NPPs had raised public concern in a number of Western European countries to the extent that several Western governments were forced to do something about the nuclear safety problem.[5] The memories of the Chernobyl tragedy were still vivid, and the public awareness that various nuclear reactors in CEE and the FSU—commonly referred to as "ticking time-bombs" in the Western media—were operating even closer to Western Europe than the ill-fated Chernobyl NPP made remedial action all the more

[5] The most serious incidents that occurred at Eastern NPPs in the early 1990s were a fire in the turbine hall at Chernobyl unit 2 in October 1991, the rupture of a pressure channel at the Leningrad NPP in March 1992, and an extended loss of electric power and near-meltdown at the Kola NPP in February 1993 (Darst 1997: 62).

urgent. To be sure, Western concern about the threat of transboundary radioactive contamination tended to vary with geographical proximity to the Eastern trouble spots: Western countries bordering CEE and FSU countries were more concerned about the nuclear safety problem than those which were somewhat removed. Nevertheless, widespread concern about the transboundary environmental risks posed by the continued operation of Soviet-designed nuclear reactors no doubt constituted a major driving force behind the subsequent actions of a number of Western countries to improve nuclear safety in CEE and the FSU.

The interests of various Western countries in addressing the nuclear safety problem were not confined to environmental concerns. Those Western countries that relied heavily on nuclear power for their domestic energy supply were deeply concerned about the negative implications of another nuclear accident in the East for the political viability of nuclear power in their own countries. Indeed, as a consequence of the 1986 Chernobyl accident, public acceptance of nuclear power in the West had suffered seriously, and it was widely assumed that another accident would finish it off altogether (Flavin and Lenssen 1996: 52-55; Economist, 24 July 1993: 19). As the then President of the French state utility Electricité de France (EdF) put it: "Another Chernobyl would be the death knell of nuclear power" (European Energy Report, April 1991: 3). An immediate abandonment of nuclear power, in turn, threatened to have unforeseeable and dire economic consequences for various Western countries. Reducing the risk of another nuclear accident in the East was thus in the interest of both the governments of those Western countries where nuclear power constituted an important part of the national energy supply, on the one hand, and the Western nuclear industry, on the other. While the former—in particular the governments of France, the United States, Belgium, the United Kingdom and also Germany—were greatly concerned with protecting the enormous investments in their domestic nuclear energy programs and preserving the nuclear option in their future energy policies[6], the latter had to fear for their commercial existence.

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[6] Preserving the nuclear option was certainly important for reasons of security of energy supply. Although nuclear power provided only around 17 percent of the world's electricity supply in 1992, various Western countries relied strongly on this source of power (see Appendix). Moreover, in the early 1990s a new factor entered into the energy policies of Western governments: Widespread concern about climate change. Various Western governments regarded the nuclear option as a potential solution to this global environmental problem due to the fact that the production of nuclear power does not release any CO_2 into the atmosphere. For example, it has been estimated that Germany would produce 20 percent more CO_2 if it were to opt out of its nuclear energy program (ATW, August/September 1991: 371).

The nuclear safety problem in CEE and the FSU did not only represent a serious threat to the political viability of nuclear power in the West, but also created tremendous commercial opportunities for Western nuclear firms and their governmental supporters. Indeed, the prospect of gaining access to the new and potentially expanding nuclear markets in CEE and the FSU had enticed various Western nuclear firms to lobby their respective national governments into providing extensive nuclear safety assistance to the East. The Eastern nuclear markets were attractive to the Western nuclear industry for two related reasons. First, scattered across CEE and FSU countries were 16 partly built nuclear reactors of both the VVER-440/213 and VVER-1000 design, i.e. reactors which had been deemed fit for long-term operation by Western nuclear safety experts. The construction of these reactors had been halted in the late 1980s and early 1990s either due to public opposition to nuclear power in the aftermath of the Chernobyl accident (especially in Russia and Ukraine) or due to financial and technical constraints on the part of the Eastern countries. Western nuclear firms were for commercial reasons eager to win contracts to complete one of these unfinished nuclear reactors. Moreover, Western nuclear firms could also secure commercial benefits by participating in government-funded nuclear safety upgrade programs. Although financially less attractive than completing partly built VVER-213s and VVER-1000s, the upgrading of various unsafe Soviet-designed nuclear reactors promised to furnish Western nuclear firms with the knowledge of Soviet nuclear technology considered indispensable for a future commercial conquest of the Eastern nuclear markets.

Second, Western nuclear firms were all the more desperate to capitalize on these business opportunities in the East as they faced moribund nuclear markets at home. Indeed, in the United States no new NPP has been ordered, without subsequently being canceled, since 1974. In Western Europe, every nuclear country with the exception of France has a moratorium on the construction of new NPPs, either officially, as in the United Kingdom or Switzerland, or de facto, as in Spain and Germany. And even the French nuclear program has slowed down dramatically since the late 1980s (Connolly 1997: 105; Economist, 21 November 1992: 25).

The decline of nuclear power in the West can be largely attributed to the growing public opposition to this technology. The nuclear accidents at Three Miles Island (1979) and Chernobyl (1986) and the hitherto unresolved issue of how to deal with radioactive waste have conspired to erode public support for nuclear power. Economic factors also account for the growing problems of nuclear power in the West. Since the late 1980s nuclear power has

been facing increasing competition from electricity generated by fossil fuels, especially natural gas, which are plentiful and inexpensive. High interest rates during the 1980s and early 1990s have served to increase the already high capital costs of nuclear power. The other cost components of nuclear power—operation and maintenance, fuel and decommissioning—have also risen due to the growing stringency of nuclear safety standards imposed by Western governments. Finally, a general trend towards economic liberalization and deregulation in the West—with concomitant cuts in government subsidies—has served to further undermine the economic case for nuclear power. These economic and political developments have given rise in the West to what is commonly referred to as the "dash for gas". Combined-cycle gas turbine plants have economic advantages over NPPs and other power generation facilities due to their short construction times and low capital costs.[7] The resulting decline in orders for new NPPs in the West has left the Western nuclear industry to be primarily concerned with maintaining the safe and reliable operation of existing NPPs and, where appropriate, seeking to extend their operating life. However, such activities alone were unlikely to sustain the industry's commercial survival in the long term (Frogatt 1999).

In short, many Western nuclear firms regarded the Eastern nuclear market as a kind of lifeline that could help secure their commercial survival until new business opportunities emerged in the West. Pro-nuclear Western governments, on the other hand, perceived the provision of nuclear safety assistance to the East as a politically convenient means to subsidize their suffering domestic nuclear industries and to help them gain a foothold in the potentially lucrative Eastern nuclear market (NW, 6 February 1992: 3-4; Economist, 1 March 1997: 18-19).

The interests of those CEE and FSU countries operating Soviet-designed nuclear reactors contrasted sharply with the interests of Western countries. Although there had been widespread anti-nuclear sentiment in a number of Eastern countries following the 1986 Chernobyl accident, public concern about the safety of the operational Soviet-designed nuclear reactors began to disappear in the East as it was growing in the West. In light of the harsh realities of newly gained national independence and the hardships of the subsequent

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[7] As a rule of thumb, capital costs amount to over 50 percent of the lifetime costs of a NPP, as compared to only 25-35 percent of the lifetime costs for a comparable coal-fired station and even less for a gas-fired station (Economist, 21 November 1992: 26). According to one energy expert, it would cost about £3 billion (nearly $5 billion) and take up to seven years to build a 1'000 MW nuclear power station in the United Kingdom while a gas-fired power station with similar capacity would cost about £400 million (about $650 million) and take less than two years to complete (FT, 2 December 1996).

economic transformation process, citizens of Eastern countries lost whatever interest they previously had in environmental activism (Darst 1997: 61-62). In addition, Eastern governments which faced new and considerable economic and political constraints following the collapse of the Soviet Union increasingly perceived their Soviet-designed nuclear reactors as valuable economic and political assets and were thus reluctant to prematurely close nuclear reactors considered by Western nuclear safety experts to pose unacceptable safety risks. Since the specific interests of the Eastern governments will be dealt with in detail in the following case studies, it suffices here to present a short summary of the factors determining the position of Eastern governments.

To begin with, nuclear power represents for all CEE and FSU countries the cheapest source of energy. This is largely due to the fact that the capital costs of NPPs—the largest single cost component of nuclear power—have long since been paid off. Moreover, following the dissolution of the Soviet Union, Russia demanded ever increasing prices for fossil fuel deliveries to its former sister republics and Eastern European allies. Given the economic advantage of nuclear power over alternative sources of energy, almost all Eastern countries increased in the early 1990s their reliance on electricity generated at existing NPPs. The growing relative importance of nuclear power for the energy supply of most Eastern countries, in turn, made an early retirement of operational nuclear reactors an extremely costly venture (Economist, 24 July 1993: 19-21). In addition, the closure of various NPPs threatened to result in social dislocation—nuclear facilities in the East employ huge workforces—, and most Eastern government were concerned about incurring the significant costs of decommissioning closed nuclear units. Moreover, for some Eastern countries the existing NPPs provided a welcome opportunity to export electricity in exchange for much needed hard currency. Finally, it was a strategic policy objective of several Eastern governments to reduce their traditionally high energy dependence on Russia. This policy goal called for a greater reliance on the available domestic energy supplies, in particular nuclear power (Connolly and List 1996: 240-242). In short, while most Eastern governments were in principle aware of the risks posed by the continued operation of Soviet-designed nuclear reactors, they lacked both the means and the incentives to unilaterally solve the nuclear safety problem and were generally bent on keeping their unsafe nuclear reactors in operation as long as possible.

3.3 Potential Strategies and Measures to Solve the Nuclear Safety Problem

Having realized that the CEE and FSU countries were unwilling and/or unable to unilaterally reduce or eliminate the safety risk posed by the continued operation of unsafe Soviet-designed nuclear reactors, the Western countries had to determine the cooperation strategies by which the Eastern countries could be induced or enabled to alter their externality-generating behavior. Various strategies, or combinations of strategies, were considered. The Western countries could transfer money, technology and know-how to entice or enable the Eastern recipient countries to reduce or even eliminate the risk of a nuclear accident (positive incentive strategies). They could also try to make the provision of economic aid and other benefits dependent on the willingness of Eastern governments to comply with Western nuclear safety demands (positive issue-linkage strategies). Conversely, the Western countries could attempt to force Eastern countries to reduce or eliminate the risk of a nuclear accident by coercive means such as economic sanctions or the suspension of economic aid (negative incentive strategies). A further possible strategy would be to furnish Eastern officials with new and more accurate information so as to make them fully aware of the costs and risks involved in the continued operation of these unsafe reactors (cognitive strategies). Finally, Western officials could try to persuade Eastern authorities by means of dialogue and education to assign top policy priority to high levels of nuclear safety (normative strategies).

With a view to the theoretical propositions outlined in section 2.2, it should not be surprising that the cooperation strategies predominantly employed by Western countries involved positive incentives. Indeed, that section has shown that states seeking to achieve and sustain cooperative outcomes in situations involving asymmetric preferences and capacities are likely to employ positive incentives. And the situation in which Western and Eastern countries interacted to address the nuclear safety problem was in fact determined by severe asymmetric preferences and capacities: While the former were for various reasons strongly interested in reducing or eliminating the risk of another nuclear accident in the East, the latter neither had the financial and technical capacities nor the immediate incentives to solve the nuclear safety problem.

The Western donor countries were subsequently confronted with the question how, i.e. in which specific ways, to employ positive incentives. This question is not only of practical interest, but also relevant for assessing what has been referred to in the analytical framework as the *second dimension of efficiency*. Indeed, it has been argued above that alternative ways of employing positive incentives, i.e. the funding and implementation of different capacity-

building measures, vary in terms of their cost-effectiveness in reducing negative externalities. Before the various ways by which the Western donors could employ positive incentives to solve the nuclear safety problem are explored, it is first necessary to briefly elaborate on what a solution to the nuclear safety problem implied for the Western donors.

Basically the Western countries wanted to reduce as far as possible the risk of a nuclear accident at one of the operational Soviet-designed nuclear reactors in CEE and the FSU. In other words, the more risk reduction, the better. However, a satisfactory solution to the nuclear safety problem from the viewpoint of the Western donors could only be achieved if the risk of a nuclear accident in CEE and the FSU was reduced to what Western nuclear safety experts regarded as "acceptable" risk levels. While a certain level of risk is inherent in the production of nuclear power, it was the high or unacceptable safety risk posed by the continued operation of certain Soviet-designed nuclear reactors that prompted the Western countries into action. For the purposes of this study it is not necessary to specify what "acceptable" risk levels imply, which in any case would be rather difficult to do. However, what is indeed relevant is the fact that Western nuclear safety experts had concluded in the early 1990s that the VVER-230s and RBMKs—so-called *high-risk nuclear reactors*—could not be upgraded to reach international safety standards. This conclusion implied that while the implementation of various safety-enhancing measures could reduce the risk of a nuclear accident at one of these reactors to a certain degree, this reduced degree of risk would still not be acceptable from the viewpoint of Western countries and could not be further decreased by additional safety improvements. In abstract terms, risk reduction at VVER-230s and RBMKs is best viewed as a discontinuum: The marginal utility of each additional unit of safety-enhancing measures implemented at a high-risk nuclear reactor decreases up to a certain point where no additional unit of safety-enhancing measures, but only the closure of the nuclear reactor, can generate further safety benefits. It was for these reasons that Western nuclear safety experts recommended that VVER-230s and RBMKs be shut down as soon as feasible. In short, while the Western donors could secure certain safety benefits by financing and implementing measures designed to reduce risk levels at VVER-230s and RBMKs, a satisfactory and lasting solution to the nuclear safety problem in CEE and the FSU could only be achieved by inducing or enabling the Eastern recipient countries to shut down these nuclear reactors as soon as possible.

As outlined above, the safety of Soviet-designed nuclear reactors, in particular of VVER-230s and RBMKs, was hampered by a combination of various design flaws,

operational deficiencies and weak regulatory regimes. Hence, the Western donors could reduce to a certain extent the risk of a nuclear accident at one of these reactors by financing and implementing the following *safety-enhancing measures*:

- Technical safety upgrades to VVER-230s and RBMKs
- Improving the material conditions for operation and promoting a "safety culture" among the small, but critical group of NPP operators
- Increasing the technical and financial resources of nuclear safety authorities and enhancing their independence and organizational clout

While perhaps necessary to address immediate nuclear safety concerns, these safety-enhancing measures were unlikely to lead to a lasting solution to the nuclear safety problem in CEE and the FSU. Indeed, the Western donors could gain major safety benefits only by securing the premature closure of high-risk nuclear reactors. However, Eastern governments were reluctant and/or incapable to comply with Western closure demands. One important—though not the only—factor determining the reluctance of Eastern governments to comply with Western closure demands was the fact that these countries depended to varying degrees on the power generated by unsafe nuclear reactors. It was hence evident that the Western donors would have to employ positive incentives so as to compensate Eastern countries for the power foregone by the premature closure of unsafe nuclear reactors. This goal could be achieved by the implementation of either supply-side or demand-side measures. Supply-side measures are basically designed to provide new or additional electricity generating capacity. The Western donors could thus seek to enhance the electricity generating capacity of Eastern recipient countries by providing resources for one or a combination of the following *supply-side measures*:

- Completion of unfinished and upgradeable VVER-213 and VVER-1000 reactors
- Construction of new Western-type nuclear reactors
- Construction of new conventional power plants (hydroelectric and thermal power plants)
- Modernization and upgrading of existing conventional power plants

Providing various Eastern countries with the financial and technical means to complete and upgrade unfinished VVER-213 and VVER-1000 reactors was at first sight an obvious course of action for the West. The Eastern countries had sunk enormous investments in these projects

and were therefore strongly interested in completing these partly built reactors to recoup otherwise lost investments. The possibility of constructing new Western-type reactors in the East, on the other hand, was an option that—although being briefly floated in 1990/1991—never really made it on the agenda due to its enormous financial costs and risks both for the Western donors and the Eastern recipients. In contrast, constructing new and less capital-intensive hydroelectric or thermal power plants tended to be a more cost-effective supply-side measure. However, many Eastern governments were somewhat reluctant to construct new fossil-fired generation capacity due to their concern of thereby increasing energy dependence on Russia and/or exacerbating balance of payments problems. Modernizing and upgrading existing conventional power plants also promised to be a cost-effective measure. Indeed, since many of these power plants were using outdated technology and were hampered by poor maintenance records, the conventional energy sector in the East as a whole operated at rather low productivity levels. Modernizing these plants would allow them to operate more efficiently, i.e. produce more power with the same input.

On the other hand, the Western donors could also finance and support the implementation of *demand-side measures* in an effort to make the Eastern countries more energy-efficient. The rationale behind such measures was that a more efficient use of the available energy supplies was likely to reduce these countries' reliance on unsafe nuclear power and thereby facilitate the near-term closure of high-risk nuclear reactors. Promoting the efficient use of energy in the East promised to be a very cost-effective way of employing positive incentives because there was such a huge energy savings potential in the region.[8] Indeed, in the early 1990s it was estimated that around 30 percent of the energy used in the former Eastern bloc could be easily saved (EEE Report, September 1993: 7). It was thus apparent that only a small increase in energy-efficiency would significantly reduce these countries' energy demands, and consequently also their reliance on nuclear power generated by high-risk nuclear reactors. Hence, by transferring fuel-efficient technology and equipment

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[8] The fact that enormous amounts of energy were and still are wasted in CEE and FSU countries can be traced back both to the policies by which the Soviet Union had sought to secure its domination over the former Eastern bloc and to the distorted incentive structure of the socialist command economy. During the Cold War the Soviet Union had sponsored various energy projects in Eastern European countries and had supplied highly subsidized energy resources. The strategic aim of this policy had been to deepen the dependence of these countries on Soviet technology and energy transfers. Not surprisingly, the very availability of these presumably inexhaustible and cheap energy resources—energy prices bore little relation to economic cost—enticed the Eastern European command economies to develop highly inefficient and energy-hungry industrial and housing structures. Under this system of low energy prices, it was only rational for the population to perceive energy not as a scarce resource, but as an entitlement. There was thus little incentive to measure and conserve energy or to invest in more fuel-efficient technology and equipment (Balabanov 1998: 71-73).

and by assisting the Eastern countries to completely overhaul and reform their energy sectors, including the pricing, billing and collection systems, the Western donors had an opportunity to help secure the premature closure of high-risk nuclear reactors at comparatively low cost. However, it must be noted that the effectiveness of demand-side measures depended on the willingness of Eastern governments to introduce market reforms in the energy sector because as long as energy prices did not reflect true production costs, there would be no incentive for energy saving.

In sum, this section has elaborated on the reasons why the Western donors addressed the nuclear safety problem predominantly by positive incentive strategies and has explored various ways by which the Western donors could employ positive incentives. Furthermore, this section has also provided analytical benchmarks against which the efficiency of positive incentives (second dimension) may be assessed in the individual case studies. However, it must be emphasized that the set of capacity-building measures outlined in this section is neither exhaustive, nor does it imply that all these measures are necessarily applicable in each "case"—and hence that the relative cost-effectiveness of all these measures are assessed in each individual case study. Rather, the range of potentially applicable and applied capacity-building measures is determined by the specific nature of each individual "case". As such each case study will examine the relative cost-effectiveness of only a limited selection of the capacity-building measures outlined above.

3.4 The West's Initial Response to the Nuclear Safety Problem

The analysis of the political basics of the nuclear safety problem in CEE and the FSU has so far demonstrated that there were competing interests both between Western and Eastern countries, and among the Western donor states themselves. First, the strong asymmetries of preferences and capacities between Western and Eastern countries were likely to make successful cooperation, in particular on the closure front, a very difficult undertaking. Second, the specific nature of the benefits to be gained by Western countries from addressing the safety threat was bound to give rise to divisions among Western donor countries and consequently have serious implications for the West's overall approach to the nuclear safety problem. Indeed, those Western countries located geographically nearer to the various trouble spots in the East were enticed to act due to the predominantly *public benefits* flowing from the reduced environmental risk of a nuclear disaster and hence called for the earliest possible closure of unsafe reactors. The major Western nuclear countries, on the other hand, perceived

predominantly *private benefits* resulting from the opportunity of both protecting their own nuclear power programs and domestic nuclear industries from yet another debilitating accident and helping their ailing nuclear industries to gain a foothold in the Eastern nuclear market. These countries thus tended to adhere to a more pragmatic approach and generally accepted that most high-risk nuclear reactors in the East would continue to operate for years to come.

Against this backdrop, the following section describes the West's initial response to the nuclear safety problem in the East. This description is introduced with a brief discussion of the international institutional context in which the Western countries had started to address the nuclear safety problem in CEE and the FSU and their ensuing efforts to create an international regime for the safe use of nuclear power. Thereafter a brief overview of the major Western nuclear safety assistance programs is presented.

International Institutional Framework Regulating Nuclear Safety

As the West began to perceive the operation of Soviet-designed nuclear reactors as a serious transnational safety threat, the international institutional framework regulating nuclear safety issues was rather underdeveloped. Indeed, although a few international regimes existed in the field of nuclear safety, for example the Paris (1960) and Vienna (1963) Conventions on Nuclear Liability and the two IAEA Notification and Assistance Conventions (1986), these regimes neither had the mandate, nor the clout to guarantee a sufficient level of nuclear safety in states operating nuclear reactors. The same conclusion applies to the IAEA that lacks the authority to enforce international safety standards. The absence of strong international regimes and institutions in the field of nuclear safety can be mainly attributed to the fact that nuclear power has always been regarded as a prerogative of sovereign states. This in turn has much to do with reasons of national security, in particular with the close connections between nuclear power and the development of nuclear weapons (Foss 1999: 65).

The nuclear safety problem in CEE and the FSU provided a fresh impetus to intergovernmental efforts aimed at strengthening the international institutional framework regulating nuclear safety issues. In September 1991 the IAEA General Conference officially launched the idea of a binding nuclear safety convention. A number of Western governments considered such a convention as a useful means to secure the premature shutdown of unsafe nuclear reactors, strengthen public acceptance of nuclear power, and to increase the level of nuclear safety worldwide by promoting exchanges of technology, experience and know-how

among engineers and NPP operators. And even the Eastern countries—whose unsafe nuclear reactors was the ultimate target of the proposed convention—were initially not reluctant to consider the idea because they hoped that it would generate larger amounts of international assistance (NW, 5 September 1991: 1, 10-12). Despite the strong support the idea initially enjoyed among many governments, negotiations on a binding nuclear safety convention were hopelessly bogged down by mid-1993. Apart from the contentious issues regarding the scope and content of such a convention, disagreement prevailed especially over how far any set of safety standards should trespass on national sovereignty and whether the proposed convention should be coercive in nature (NW, 16 April 1992: 6-7; NW, 8 July 1993: 14-15). Only after the original proposals had been significantly watered down was a first draft agreed upon in early 1994. After the minimum number of signatories had been finally secured three years later the so-called International Convention on Nuclear Safety (CNS) entered into force in October 1996.[9]

The principal aim of the CNS is to enhance levels of nuclear safety worldwide via a process of self-assessment augmented by formal reporting at periodic peer reviews. The convention neither sets binding technical standards, nor demands costly actions such as the shutdown of unsafe nuclear power plants.[10] Instead, it commits parties to promote nuclear safety through better regulatory organization, legislation, financial and human resources, safety assessment and research, and safety upgrading. In addition, the CNS neither provides for means to verify whether parties meet the convention's rather vaguely defined obligations, nor for sanctions against parties with poor compliance records. The convention essentially relies on peer review pressure to induce parties to comply with their formal obligations (NW, 29 April 1999: 7-9).

In short, despite ongoing efforts since 1991 to establish a more stringent international regime regulating national nuclear power programs, the international institutional framework in the field of nuclear safety remained weak and underdeveloped. As a result, the Western

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[9] As of January 2000, the CNS has been acceded to or ratified by 53 countries, including 30 of the total 32 countries with operating NPPs. The remaining two nuclear countries that have so far not acceded to or ratified the convention are Kazakhstan and India (see website of the IAEA at: http://www.iaea.or.at/worldatom/Documents/Legal/nukesafety.shtml).

[10] The CNS calls on parties to upgrade unsafe NPPs and, if not practicable, to shut them down as soon as possible. However, the convention contains an "escape-clause" for the shutdown of plants, conceding that the timing of any shutdown may be determined by the whole energy context and the estimated socio-economic impact (NN, June 1999: 56-57).

response to the threat posed by the continued operation of Soviet-designed nuclear reactors had to be initiated and managed on a more or less ad hoc basis.

Major Nuclear Safety Assistance Programs

In late 1990 and early 1991 both the EU and various other Western countries launched a number of assistance programs to address the nuclear safety problem in the East. The EU, which is by far the most important donor in terms of financial contributions, channeled its nuclear safety assistance through its PHARE program for CEE countries (including the Baltic states) and its TACIS program for the states of the FSU.[11] The PHARE and TACIS programs are designed to provide grant assistance to Eastern countries with the overall aim to help them restructure their economies and build stable democratic institutions (Herttrich et al. 1994: 95).

Nuclear safety projects funded under PHARE and TACIS focused on the following activities: Strengthening nuclear regulatory bodies, implementing operational safety improvements, conducting safety studies and providing basic safety equipment for NPPs (Nuclear Energy Institute 1997: 35-37). Funds committed under the EU's nuclear safety programs overwhelmingly took the form of technical or "software-related" assistance and did not directly address problems of hardware design. The EU's technical assistance was widely criticized as being extremely bureaucratic and slow and as representing blatant subsidies to consultants from EU Member States' nuclear industries. In addition, the EU's nuclear safety programs suffered from internal coordination problems. Indeed, by 1993 the EU had proven unable to establish an efficient framework for cooperation between the five Director-Generalships (DG) involved in the field of nuclear safety, and even within the DG for Foreign Affairs there was virtually no coordination between officials responsible for PHARE and TACIS (NW, 23 December 1993: 6). A further characteristic of the EU's nuclear safety programs was the absence of explicit conditionality. Arguing that it was the sovereign responsibility of each recipient government to determine its national energy policies, the EU initially made no explicit attempt to condition its grant aid on commitments by Eastern governments to prematurely close unsafe nuclear reactors (Connolly and List 1996: 248-249).

The EU's nuclear safety assistance was not restricted to grants from the PHARE and TACIS programs, but also included funds from the Euratom loan facility. Euratom—an

[11] In the first three years of Western nuclear safety aid programs to CEE and FSU countries, the EU had provided nearly two thirds of the total amount of Western assistance (Connolly and List 1996: 248). For the historical development of Western nuclear safety assistance, see Appendix.

acronym for the European Atomic Energy Community—was established in 1957 with a mandate to promote the safe and peaceful use of atomic energy. Its loan facility was designed to contribute to the financing of NPPs in the Community's Member States. In late 1992 the European Commission proposed to extend Euratom's lending mandate to include CEE and FSU countries. The Commission's proposal to extend Euratom's lending mandate was based on the reasoning that due to the falling demand for Euratom loans among EU Member States and the dim prospects that this demand would recover in the near-term, the remaining loans in the fund—around ECU 1 billion (then about $1.2 billion)—could be used to improve nuclear safety in the East, in particular for the completion of partly built Soviet-designed nuclear reactors. In March 1994 the European Council agreed to change Euratom's lending mandate on the condition that Euratom loans would be used only for projects in which the majority of the financed capital goods or services were provided by a company from a EU Member State (Frogatt 1999).

Various bilateral aid programs provided the second largest source of Western nuclear safety assistance. Bilateral aid programs initially focused on funding safety studies and measures aimed at improving the inadequate "safety culture" at various Eastern NPPs, but gradually also addressed hardware problems. Although bilateral nuclear safety assistance has proven to be advantageous in terms of speed of disbursement, its major drawback was that it was uncoordinated by design, despite early efforts by the G-24 to coordinate aid strategies among Western donors.[12] This lack of coordination has allowed donors to pursue quite different approaches to the nuclear safety problem. Indeed, while certain Western countries—in particular Germany and Austria—pressed for the earliest possible closure of unsafe reactors and wanted Western aid to be firmly tied to shutdown commitments by Eastern governments, other Western donors adhered to a more pragmatic approach and were basically willing to provide nuclear safety assistance without insisting on rigorous conditions (Connolly and List 1996: 243-245).

The initial failure of the Western donor governments to coordinate policies and attach conditions to their aid programs was largely determined by the tremendous business

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[12] In an attempt to impose more order on the dissemination of aid to the East, the G-24 had created a Nuclear Safety Working Group in mid-1991 and subsequently set up a database to monitor all technical assistance programs and projects being implemented in the East. Since its initial efforts proved to be ineffective, the G-24 established a 10-country executive steering committee in July 1992 and requested its secretariat, the Nuclear Safety Assistance Coordination Center (NUSAC), to improve the coordination of assistance programs (Nuclear Energy Institute 1997: 32).

opportunities involved in improving nuclear safety in the East. Indeed, various Western nuclear firms had immediately engaged in an intense commercial battle for lucrative safety upgrade contracts. Commercial competition was particularly intense in the early stages of the West's safety upgrade efforts since Western nuclear firms were eager to develop their expertise of Soviet nuclear technology and acquaint themselves with the prevailing conditions in the Eastern nuclear markets in order to be well positioned for future nuclear upgrade and construction contracts. This fierce commercial competition among nuclear firms, in turn, had led several Western governments—torn between the desire to solve the nuclear safety problem in the East and to support their own crisis-ridden nuclear industries—to provide unconditional assistance and to abstain from tightly coordinating their aid programs with other donors. Since Eastern governments were generally reluctant to accept tough conditions imposed on nuclear safety assistance programs, a number of Western donor governments shrank from attaching strings to their aid out of fear of losing commercial benefits. The desire to secure commercial benefits also accounts for the initial lack of policy-coordination among the Western donors. In contrast to a coordinated or multilateral approach to the problem, in which private benefits would be more equally distributed among donor states, bilateral aid programs secured individual donors both more control over how financial resources were allotted and better opportunities to win business contracts. An uncoordinated approach among the donor states, however, allowed recipient governments to play donors against each other and, consequently, to avoid any costly aid conditions (MacLachlan 1996b: 1).

Given the strong incentives of Eastern governments to keep their unsafe nuclear reactors in operation as long as possible, it was evident that a satisfactory and lasting solution to the nuclear safety problem depended to a large extent on the willingness and ability of the Western donor countries to pool their resources and stick to common policies of conditionality. Realizing these constraints, those Western countries most interested in reducing or eliminating the risk posed by the continued operation of high-risk nuclear reactors—in particular Germany due to its close proximity to Eastern NPPs, but also France which was concerned about the consequences of another nuclear accident in the East for the future of its nuclear power program—pressed for a more coherent and comprehensive approach to the nuclear safety problem (NW, 12 March 1992: 1, 10-11; NW, 16 April 1992: 13-14). By mid-1992, their combined efforts had succeeded at least in the sense of mobilizing additional Western assistance and achieving agreement on the broad principles of a new action plan. At the July 1992 economic summit of the G-7 in Munich, the seven leading

economic powers of the West agreed to provide $700 million in grants over a period of five years for a five-point action program. Short-term safety measures were identified in the following three areas (NucNet, 27 July 1992):

- Operational safety improvements (estimated costs: $360 million).
- Short-term technical improvements to RBMKs and VVER-230s, which would allow these reactors to operate at lower risk until they were shut down (estimated costs: $320 million).
- Enhancing regulatory regimes. This measure sought to improve the ability of Eastern regulatory authorities to implement and maintain higher levels of safety at operational NPPs and to refuse licensing of NPPs if required on safety grounds (estimated costs: $20 million).

In addition, the following long-term measures were envisaged by the G-7 action plan:

- The investigation of energy efficiency measures and alternative energy sources for Eastern countries, so that the need for power from unsafe reactors could be reduced.
- The examination of the potential for upgrading nuclear reactors considered to have a higher level of safety, i.e. VVER-1000s and VVER-440/213s.

Although the G-7 countries were able to agree in Munich on the total amount of funds to be appropriated for the action program, disagreement prevailed over how to manage financing for the planned short-term safety measures. The European G-7 members wanted to create a multilateral assistance fund for this purpose. They reckoned that such a funding mechanism would minimize cut-throat commercial competition among Western nuclear firms and the danger that the most dangerous plants would be left aside while each Western donor picked out those plants it was most interested in. Moreover, they argued that a multilateral fund would enhance the Western donors' leverage in bargaining shutdown commitments with Eastern governments. However, the non-European G-7 members, in particular the United States and Japan, favored organizing aid on a bilateral basis, with nothing more international than a forum to prevent duplication or neglect (Economist, 15 August 1992: 18). While the Bush administration officially cited the creation of a new and unwieldy bureaucracy as its motive to reject a multilateral fund, the Japanese government pointed to the unresolved territorial dispute with Russia over the Kuril Islands. In both cases, however, the deeper reasons for opposing the idea of a multilateral fund were the advantages provided by bilateral aid programs to gain commercial benefits (List 1993: 350). Indeed, since the United States

and Japan were not directly threatened by a nuclear accident in CEE and the FSU due to their geographical location, the main impulsion for these countries to provide nuclear safety assistance was the opportunity to bring home upgrade contracts. The prospective safety-benefits of a multilateral approach were thus significantly lower for these countries than for Western European states. Moreover, since the European G-7 members wanted the newly established EBRD to administer the proposed multilateral fund, the United States and Japan were concerned that their domestic nuclear industries might be disadvantaged on the hardware backfit market through the awarding of contracts by a predominantly European financial institution. This is why the United States subsequently insisted that if at all a multilateral funding mechanism, the Washington-based World Bank should be assigned the task of managing the fund.

The protracted political debate over whether to create a multilateral fund was finally resolved in February 1993 as Germany and France threatened to proceed with the fund even without the participation of the non-European G-7 members. Acknowledging that the fund would be created in any case, and thus fearing the possibility of being left out of bidding entirely, both the United States and Japan finally acquiesced to the creation of the Nuclear Safety Account (NSA) (NW, 28 January 1993: 1, 12-13). Not surprisingly, however, their initial contributions were marginal, just enough to make them eligible for the commercial opportunities created by the fund.[13]

The NSA became effective in April 1993 with initial pledges of ECU 115 million (then about $138 million) from 13 donor countries.[14] The principal objective of the NSA is to finance, through grants, operational and near-term technical safety improvements for unsafe Soviet-designed reactors in the countries of CEE and the FSU and to secure the premature closure of these nuclear units after a specified time period. NSA funds are specifically targeted at those reactors that present the highest level of risk, i.e. VVER-230 and RBMK reactors (EBRD 1996: 2). The EBRD acts as the secretariat of the NSA and provides technical, project management, financial, legal and administrative services. The EBRD reports to NSA donors through an Assembly of Contributors that exercises overall supervision

[13] While the United States and Japan initially pledged ECU 1.5 million and 9 million, respectively, Germany and France were willing to contribute ECU 40 million each over the period 1993-1995 (List 1993: 350; NucNet, 10 March 1993).

of the management of the NSA, approves six-month work programs and decides on the financing of individual projects. Based on mandates given by the Assembly of Contributors, the EBRD negotiates grant agreements with the recipient countries on timetables for the shutdown of unsafe reactors as part of agreed strategies for their power sub-sectors. To secure the material conditions for the premature closure of unsafe nuclear reactors, the NSA works in tandem with the investment arm of the EBRD that through lending from its ordinary resources can finance the investments needed to upgrade the energy infrastructure and other forms of energy generation in recipient countries (Démarcq 1994: 13).

Following the conclusion of a NSA grant agreement, the utility operating the NPP in question is responsible for implementing the NSA upgrade projects. For this purpose the utility is required to set up a Project Management Unit (PMU) that is in charge of the day-to-day project implementation. Consultants from Western firms are usually hired to support the PMU. The EBRD assists the utility in setting up the PMU and monitors project-implementation. Procurement for all equipment and services required for NSA-funded safety upgrade projects is restricted to firms from NSA donor countries and the EBRD's countries of operations. In general, equipment procurement follows open tendering. Consulting and engineering services are procured through selective tendering among qualified firms. The NSA's procurement rules thus basically assure that awarded contracts are roughly balanced against relative contributions from donor states. In retrospect, this is the most probable reason why those Western donors not directly affected by the nuclear threat in the East increased their contributions to the fund in later years.

Although it took considerable time and infighting to establish the NSA, and even though the amount of money initially allocated to the multilateral fund was far from sufficient—not least due to the limited financial contributions of important G-7 donors such as the United States and Japan—, the creation of the NSA represented an improvement on the existing nuclear safety assistance programs in two respects. First, the NSA represented the only international forum that drew all Western donors, both European and non-European countries, into a common assistance framework. This institutional innovation put the NSA in a better position than other forums to resolve collective action problems among donors by allowing it to apply political pressure on individual donors to give priority to safety benefits

[14] The original donor countries were Canada, Denmark, Finland, France, Germany, Italy, Japan, The Netherlands, Norway, Sweden, Switzerland, the United Kingdom and the United States. Belgium joined the

over commercial gains. Second, the NSA's institutionalized links with the EBRD promised to improve the prospects of successfully enforcing conditionality policies. Indeed, in case a recipient government decided to renege on a closure agreement, it was bound to suffer considerable reputation costs, which in turn would possibly preclude further access to EBRD loans. Maintaining a good reputation was important to Eastern recipient governments since the EBRD was likely to play a leading role in capital lending to the cash-strapped region. As such it could be expected that the NSA's specific position within the EBRD would increase its bargaining leverage (Connolly and List 1996: 266-267).

However, before any Western donor could begin to effectively address the "hardware" side of the nuclear safety problem, one important legal obstacle had to be overcome: The thorny question of nuclear third-party liability. Western nuclear firms tended to shy away from hands-on work at Soviet-designed nuclear reactors out of fear of being found liable for damages if an accident occurred at an Eastern NPP where they provided or installed safety equipment (NEI, January 1995: 32-34). Western donors therefore insisted that recipient countries adhere to the principles of the Vienna and Paris Conventions that provide for an international nuclear liability regime.[15] Under both conventions, the operator of a nuclear installation is exclusively liable for accidents at and in relation to that installation, including accidents in the course of transport of nuclear substances. This "channeling" of liability means that no legal action can be brought by victims against suppliers, carriers etc., even if the incident was attributable to the fault of one of them. The liability of the operator is therefore strict, i.e. the operator is held liable irrespective of fault. Since adequately compensating victims of a nuclear accident would doubtless exceed the financial means of any nuclear operator, both conventions call upon parties to provide a minimum amount of state guarantees.

NSA's Assembly of Contributors in 1994 and the EU also made a significant contribution to the fund (ECU 20 million). By late 1996, the aforementioned 15 donors had allocated ECU 257.2 million (EBRD 1996: 3).

[15] While the 1960 Paris Convention is limited to Western European states, the 1963 Vienna Convention is worldwide in scope, albeit without enjoying universal membership. In 1988, the parties to both conventions adopted a Joint Protocol linking the two (Darst 1997: 63).

These financial obligations, however, served to deter the financially strapped Eastern countries from adhering to the international nuclear liability regime.[16] An additional reason for the difficulties in bringing Eastern countries in line with the international liability regime was the necessity of convention parties to enact national nuclear legislation and hence implement the liability principles. Indeed, since Eastern countries were unfamiliar with legal concepts such as nuclear liability insurance, it took them considerable time and effort to formulate and implement national nuclear laws (Krzyak 1995: 116).

[16] Both the Paris and the Vienna conventions provide for clear financial limitations on the amount of liability to be assumed by parties—the 1960 Paris Convention for example sets a maximum liability of 15 million SDRs (Special Drawing Rights of the IMF; 1 SDR is worth roughly $1.20). Since the early 1990s, Western parties have been demanding that compensation in the form of state guarantees should amount to at least 150 million SDRs, which is in fact still very little when compared to the potential damages (NEI, January 1995: 33; MacLachlan 1996b: 4).

4 CASE STUDY I: THE NSA'S CLOSURE DEAL WITH BULGARIA

Ever since a 1991 IAEA-mission to Bulgaria had concluded that safety conditions at the four VVER-230 reactors of the Kozloduy NPP were critical and demanded immediate action, Western countries and organizations had been trying to improve the safety of Kozloduy units 1-4 and to persuade the Bulgarian authorities to prematurely close these four units. In June 1993 the NSA concluded a grant agreement with the Bulgarian government in which it agreed to provide ECU 24 million for near-term safety upgrades at the Kozloduy NPP. In exchange, the Bulgarian government promised to close Kozloduy units 1-4 in 1997/1998 provided that a number of energy projects financed by IFIs had been completed by that time. While the NSA-funded safety upgrade program was successfully implemented, the Bulgarian government refused in 1998 to comply with its closure commitments, allegedly because the set of investments in the country's energy sector had not sufficiently materialized, and announced plans to further upgrade Kozloduy units 1-4 for prolonged operation.

The outcomes to be explained can be summarized as follows. *Effectiveness*: The provision of positive incentives enabled the Bulgarian authorities to reduce the risk of a nuclear accident at the Kozloduy NPP to a certain extent, but ultimately failed to secure the premature closure of Kozloduy units 1-4. As such the effectiveness of the transaction was rather low. *Efficiency*: The transaction was efficient in the sense that the employment of no other cooperation strategy could have secured a comparable or superior behavioral change on the part of Bulgaria at a lower or comparable cost (first dimension of efficiency). On the other hand, the efficiency of the transaction was rather low in terms of the second dimension of efficiency: It is not impossible that other ways of employing positive incentives could have led to a more favorable result. These outcomes were shaped by the following problems. The effectiveness of the transaction was seriously hampered by the "slippery slope effect". Moreover, enforcement and coordination problems among the donors also negatively affected the effectiveness of the transaction. The efficiency of the transaction (second dimension) was hampered by the rather pro-nuclear problem-definition adhered to by the Western donors.

The case study on the NSA's closure deal with Bulgaria is structured along the following lines. The first section provides a brief introduction to the energy situation in Bulgaria and discusses why a domestic solution to the nuclear safety problem in Bulgaria was difficult if not impossible. The second section elaborates on the provisions of the 1993 NSA agreement and explains why a closure agreement was concluded despite reservations on both

sides. The third section, which is structured into two parts, analyzes the implementation of the NSA agreement. Whereas the first part of this section describes the problems involved in implementing the NSA-funded safety upgrade program at the Kozloduy NPP, the second part examines the troublesome implementation of the various energy projects envisaged by the NSA agreement and explains why the Bulgarian government ultimately refused to comply with its closure commitments. The results of the case study are summarized in the fourth and final section.

4.1 The Energy Situation in Bulgaria

During the early 1990s, Bulgaria's total installed electricity capacity amounted to about 11'360 MW and was based on a troubled mix of the unsafe Kozloduy NPP and a number of aging thermal and hydroelectric power plants. The country's six nuclear reactors at the Kozloduy NPP—four VVER-230s and two VVER-1000s—have an installed net capacity of 3'420 MW, thus accounting for around 30 percent of Bulgaria's total generation capacity. Bulgaria's thermal power plants (including combined heat and power plants) accounted for 54 percent and its hydroelectric facilities for 16 percent of total generation capacity (EEE Report Profiles, 1995a: 12-14; IEA 1994: 56-57). In the 1980s, the Bulgarian authorities had planned to increase the country's nuclear generating capacity with the construction of two VVER-1000 units at the Belene NPP. However, due to local protests and the country's economic slowdown, the Bulgarian government decided in mid-1991 to cancel the construction project (Nuclear Energy Institute 1997: 310).

TABLE 4.1: OPERATING NUCLEAR REACTORS IN BULGARIA

Power Unit	Reactor Type	Capacity (Net, MW)	Commercial Start
Kozloduy 1	VVER-440/230	400	1974
Kozloduy 2	VVER-440/230	400	1975
Kozloduy 3	VVER-440/230	400	1981
Kozloduy 4	VVER-440/230	400	1982
Kozloduy 5	VVER-1000	910	1988
Kozloduy 6	VVER-1000	910	1993

Note: Kozloduy units 3 and 4 are a more modern version of the VVER-440/230 design. Kozloduy-6 was connected to the grid in 1991, but it took until 1993 to start commercial operations. Source: Kurtz 1996: 122.

In the early 1990s, Bulgaria experienced serious difficulties in meeting its energy needs—despite the fact that domestic energy demand had dropped drastically due to the sharp decline

in industrial production since 1989. As a result, the Bulgarian government had been forced to ration electricity supply during periods of heavy demand, i.e. in particular during the cold winter months. Bulgaria's critical energy situation during the early 1990s was to a large extent determined by the poor performance of the country's existing power plants (EEE Report Profiles 1995a).[1] Not only had it proved difficult to maintain previous power output levels at the Kozloduy NPP due to frequent forced shutdowns, but also the country's thermal power plants failed to reach their true potential due to their deteriorating condition: Around 60 percent of Bulgaria's thermal power generation capacity had been at the time in operation for over 20 years and had not undergone major modernization work since.

Further exacerbating the country's critical energy situation was the fact that Bulgaria had to pay increasing prices for fossil fuel imports from Russia and Ukraine. While Bulgaria was endowed with large supplies of low quality lignite coal, it had to import over 90 percent of its oil and gas (Kurtz 1996: 121). Previously, the Soviet Union had supplied Bulgaria with ever growing quantities of cheap energy—which was in effect the major reason why Bulgaria had developed highly energy intensive and inefficient industries in the first place.[2] However, following the dissolution of the Soviet Union in 1991 the Russian government was no longer willing to support its former socialist Eastern European ally with subsidized energy supplies, and Bulgaria eventually had to pay world-market prices for its fossil fuel imports.[3] Bulgaria's energy situation during the early 1990s was not only characterized by an acute energy shortage, but also by a rising relative importance of nuclear power. While the Kozloduy NPP accounted for less than 30 percent of total electricity production in the late 1980s, this figure had gradually risen to around 37 percent by 1993, almost entirely at the expense of electricity generated at the country's thermal power plants (IEA 1994: 55). This development reflected the enhanced economic advantage of nuclear power: Although nuclear fuel imported from Russia was also subject to price hikes, its costs remained substantially below those for imported fossil fuels and even domestically produced coal.[4]

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1 The country's distribution network was also highly inefficient, with electricity losses amounting to nearly 40 percent in some areas (NEI, November 1992: 61).

2 It has been estimated that electricity intensity as a whole in Bulgaria was about three times higher per unit of GDP than the OECD average, a ratio that had increased in the early 1990s because the decline in Bulgarian GDP had been greater than the decline in power demand (EEE Report Profiles, 1995a: 10).

3 The Soviet Union also cut off electricity exports to Bulgaria in October 1991, precipitating an instant crisis in electricity supply in the country (NN, December 1991: 49).

4 Production costs at the Kozloduy NPP have been estimated to be over 50 percent lower than the production costs at the country's thermal power plants (EEE Report, May 1997: 25).

Struggling to meet the country's energy needs and coping with a wide array of other formidable socio-economic problems connected with the country's transformation process, the Bulgarian government was reluctant to comply with Western demands to immediately shut down the four VVER-230s of the Kozloduy NPP. Indeed, closing Kozloduy units 1-4 would result in the loss of over a fourth of the country's electricity supply, a sacrifice which the Bulgarian government believed it could not afford to make in face of the country's dire economic and energy situation. The preferred course of action from Sofia's point of view was thus to upgrade Kozloduy units 1-4 and allow them to operate as long as possible, at least until sufficient replacement power generation capacity was in place. However, since the Bulgarian authorities lacked both the technical expertise and the financial resources for such a complex and costly undertaking, they were dependent upon external assistance to help improve the near-term safety of Kozloduy units 1-4.

4.2 The NSA Agreement with Bulgaria

Deeply concerned that the critical safety situation at the Kozloduy NPP could result in yet another Chernobyl-style nuclear disaster, the EU reacted promptly by approving in July 1991 an ECU 11.5 million emergency grant from its PHARE program to address the plant's most urgent safety problems. With some delay both the EU emergency program and additional measures worth around $10 million had been implemented at the troubled facility by early 1993 (Nuclear Energy Institute 1997: 322). Nevertheless, safety conditions at the Kozloduy NPP remained precarious. In particular, no or only little new safety-enhancing equipment had been installed at the Kozloduy NPP—Western nuclear safety assistance had so far focused on improving safety culture, strengthening the country's nuclear regulatory authority and conducting safety studies of the plant. Bulgarian pleas for additional Western safety upgrade assistance had come at a favorable time: By April 1993 the NSA had become operational, and it had previously announced that the first grant agreement it would seek to conclude would concern the Kozloduy NPP (NW, 13 May 1993: 1-3).

The work previously undertaken in the framework of the EU emergency program proved to be conducive to the ensuing negotiations between NSA/EBRD officials and the Bulgarian government on the conclusion of an agreement because there was a broad consensus about the required safety upgrade work. In early May 1993, the management of the Kozloduy NPP presented to the EBRD a list of safety-related equipment it wanted to purchase with NSA grants. However, the amount of money the Bulgarian authorities requested was so

large that if fully allotted, comparatively little money would have been left for other nuclear safety projects the NSA was considering to fund. By early June 1993, the EBRD had worked out a number of safety priorities worth ECU 24 million (then about $29 million) that the NSA was prepared to fund. This first round of talks on a NSA grant agreement ended without results because the Bulgarian officials were reluctant to agree to a grant condition whereby they would have had to close Kozloduy units 1-2 by 1996 and units 3-4 by 1998. Having carried out some upgrade work on Kozloduy units 1-2 in the preceding years, the Bulgarian authorities were less than keen to see these units closed in three years time. As far as Kozloduy units 3-4 were concerned, the Bulgarian authorities argued that their more modern design did not justify their closure by 1998.[5] Nevertheless, two weeks later the Bulgarian government finally agreed to revised NSA-conditions and on 16 June 1993 the closure deal was sealed (NW, 10 June 1993: 10-11; NW, 24 June 1993: 13-14).

The ECU 24 million grant agreement was designed to improve near-term safety levels at the four VVER-230 units of the Kozloduy NPP and to secure these units' premature closure as soon as the country's energy situation allowed. The installation of safety equipment funded by the NSA aimed to enhance safety levels during the final operating years of these four units.[6] The Bulgarian state-owned electricity utility (NEK) was put in charge of project implementation and was requested to set up a special PMU at the plant. It was expected that the NSA-funded safety upgrade program at Kozloduy units 1-4 would be completed within about 18 months, i.e. by early 1995. In exchange for the NSA grant, the Bulgarian government pledged to shut down Kozloduy units 1-2 as soon as modernization work was completed on either of the two VVER-1000s of the Kozloduy NPP (units 5-6) or on the Varna thermal power plant, and when the Chaira hydroelectric power plant was operational. These energy projects were scheduled for completion by April 1997. Furthermore, Kozloduy units 3-4 were slated to operate until both unit 5 and unit 6 of the Kozloduy NPP were modernized and the conversion of the Sofia, Kostov and Republika district heating plants to combined cycle co-generation heat and power plants had been completed. These energy projects were then expected to be completed by 1998 (NW, 24 June 1993: 13-14; Nuclear Energy Institute

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[5] Since the useful service life of a VVER-230 unit is about 25 to 30 years, the Bulgarian authorities had originally expected to operate Kozloduy units 1-2 until 2004/2005, and Kozloduy units 3-4 until 2010-2012 (NW, 11 December 1997: 13).

[6] The safety equipment financed by the ECU 24 million NSA grant included fire protection devices, vessel inspection equipment, safety valves, electrical components and new emergency feedwater systems for reactor coolant (NucNet, 17 June 1993).

1997: 323; Frogatt 1999). The NSA agreement was based on the premise that IFIs such as the EBRD or the World Bank would provide favorable loans to realize the designated energy projects and hence facilitate or "trigger" the closure of Kozloduy units 1-4 in 1997/1998.

To gain a Bulgarian closure commitment, the NSA had been obliged to phrase the terms of the grant agreement in such a way so as to allow the Bulgarian authorities room for maneuver. This had been achieved by including into the agreement indicative closure dates rather than firm deadlines for the four units' closure. Furthermore, the premature closure of Kozloduy units 1-4 had been made contingent upon the rehabilitation of the Bulgarian energy sector, including investments in new or the rehabilitation of existing electricity sources and the necessity to modernize Kozloduy units 5-6. It was thus clear from the outset that sufficient funding by IFIs for the designated energy projects would be key to meet the agreement's closure schedule. The NSA, on the other hand, was aware that in light of Bulgaria's reliance on the power produced by the Kozloduy NPP it would probably be difficult to secure future Bulgarian compliance with the terms of the agreement. Not only would the Bulgarian authorities have strong incentives to keep the upgraded Kozloduy units 1-4 in operation beyond 1997/1998, but also enforcing the agreement's closure guidelines was bound to pose serious difficulties since the NSA grant would be disbursed well before the Bulgarian authorities were expected to comply with their closure commitments. Chances for the NSA to intervene in case of Bulgarian non-compliance with the terms of the agreement were, therefore, slight. The then director of the NSA, François Démarcq, expressed his awareness of these contractual problems by terming the agreement a "pact of trust" between NSA donors and the Bulgarian authorities (NW, 24 June 1993: 14).

The following reasons account for the NSA's willingness to finance safety upgrades at Kozloduy units 1-4 despite the potential risk that Bulgaria might use the NSA-funded safety upgrades to allow these four units to operate beyond the stipulated closure dates. First, improving the dismal safety levels at Kozloduy units 1-4 was a top priority of the NSA. Second, Bulgarian pleas for Western nuclear safety assistance tended to indicate that the Bulgarian government was also deeply concerned about the poor safety conditions at the Kozloduy NPP. Thus, the NSA may have reckoned that once the country had sufficient supply capacity, the Bulgarian authorities would be willing to shut down Kozloduy units 1-4 on safety grounds. Finally, the NSA probably reasoned that a full-fledged breach of the agreement on the part of the Bulgarian government would lead Western countries and IFIs to freeze their assistance and loan financing programs. Given Bulgaria's dire economic situation,

Sofia was believed to be ill prepared to afford such sanctions. Thus, the potentially high reputation costs of non-compliance for Bulgaria tended to soothe Western concerns that Sofia might find it profitable to prolong the service lives of Kozloduy units 1-4 once these units had been upgraded.

4.3 Implementation of the NSA Agreement

The following section elaborates on the implementation of the NSA agreement. It first analyzes the problems involved in implementing the NSA-funded safety upgrade program at Kozloduy units 1-4. It then examines the troublesome implementation of the various energy projects envisaged by the NSA agreement and examines the reasons why the Bulgarian government ultimately refused to comply with the terms of the NSA agreement.

Implementation of the Safety Upgrade Program at the Kozloduy NPP

Implementing the NSA-funded safety upgrade projects at units 1-4 of the Kozloduy NPP turned out to be a problem-ridden and protracted process. Originally scheduled for completion in early 1995, it took until late 1997 to implement all safety upgrade projects. The following reasons account for the delay in the upgrade program's schedule. First, the nuclear liability issue seriously delayed the procurement and installation of safety-related equipment funded by the NSA grant (NEI, January 1995: 12-13). It took the Bulgarian government over a year to take initial steps towards the resolution of the nuclear liability problem: Only in February 1994 had it approved the text of a standard annex guaranteeing a disclaimer of liability to all contracts for the delivery of equipment or the provision of services to the plant, and it took until July 1994 for Sofia to finally sign the Vienna Convention. However, a number of Western nuclear engineering firms remained reluctant to sign NSA-contracts and see their equipment installed at Kozloduy units 1-4 until the Bulgarian Parliament had ratified the Vienna Convention and enacted national legislation based on the Convention. This was achieved only in September 1995, two years after the NSA agreement had been signed.

Second, the Bulgarian authorities—fearful of the potential loses in electricity production, especially during the cold winter months—had repeatedly proven reluctant to temporarily shut down Kozloduy units 1-4 for maintenance outages, which was in effect necessary to install the NSA-funded safety equipment. As a matter of fact, in the fall of 1995 the NSA had grown so incensed about the delays in implementing the safety upgrade program

that it threatened to freeze the further disbursement of grant money in case the Bulgarian authorities refused to temporarily shut down Kozloduy unit 4 in the following spring (NW, 5 October 1995: 4-5).

The Bulgarian authorities' reluctance to extend maintenance outages out of fear of jeopardizing the country's electricity supply was particularly exemplified in the serious conflict between the Bulgarian government and various Western countries and organizations over the restart of Kozloduy unit 1 in late 1995 (Nuclear Energy Institute 1997: 326-327). Unit 1 had been shut down in February 1995 for a five-month examination of its safety systems. During the maintenance outage, two Western European nuclear safety authorities (IPSN and GRS) had found that the resistance of unit 1's pressure vessel to large thermal shocks was insufficient, and recommended in September 1995 that the Bulgarian regulatory authority take samples from the vessel for analysis before the unit was restarted. In late September 1995 G-7 representatives met with officials of the Bulgarian government and requested that Kozloduy unit 1 not be restarted unless the condition of its pressure vessel could be ascertained to the satisfaction of Western nuclear safety experts. Arguing that it desperately needed all Kozloduy units in operation during the subsequent winter months to ensure normal power supplies, the Bulgarian government rejected the G-7's request. The French government responded to Sofia's uncooperative behavior by pulling out most EdF engineers who had been working at the Kozloduy NPP under a cooperation agreement signed in 1993. Furthermore, in late October the EU offered to provide emergency coal supplies so that the reactor could remain closed throughout the winter. However, all these efforts failed to prevent the Bulgarian authorities from restarting Kozloduy unit 1 in late 1995. In January 1996, the Bulgarian regulatory authority promised to shut down Kozloduy unit 1 in May 1996 for an examination of its pressure vessel, but only after the EU had agreed to provide over ECU 10 million in compensation for the temporary shutdown of unit 1 (EEE Report, October 1996: 32).

Finally, technical and management problems contributed to the delays in implementing the safety upgrade program at Kozloduy units 1-4 (NW, 6 February 1997: 1, 12). While the Bulgarian authorities experienced problems in setting up a functional PMU and in mobilizing local forces to implement the aid already provided—problems which generally resulted from the lack of preparation on the part of NEK and the Kozloduy NPP management—, the NSA declined to renew the contract for the project management in 1995

and had to recruit a new project manager, which consequently resulted in further delaying the implementation of the safety upgrade program.

Implementation of Energy Projects under the NSA Agreement

Although the Bulgarian government had announced its intention to set up a decommissioning fund for Kozloduy units 1-4 in April 1995 (EEE Report, April 1995: 8), it became increasingly evident in the following months that the Bulgarian authorities were not willing to abide by the closure dates stipulated in the NSA agreement. In fact, by the time the Bulgarian authorities should have had completed preparations for the closure of Kozloduy units 1-2 in 1997, the Bulgarian government declared that it would not shut down these reactors in the near future. Moreover, in early 1998 Sofia announced plans to continue operating Kozloduy units 1-2 until 2005-2006, and Kozloduy units 3-4 until 2010-2012 (NEI, April 1998: 4). The Bulgarian government justified its plans to keep these units in operation beyond the scheduled closure dates on the grounds that IFIs had failed to live up to their commitments stipulated in the NSA agreement, i.e. it argued that the planned investments in the Bulgarian energy sector had not materialized to the extent which would allow the early closure of these four reactors. Indeed, both the implementation of various conventional energy projects and the modernization of Kozloduy units 5-6 had gotten far behind the schedule outlined in the 1993 NSA agreement. As such Sofia's decision to continue operating Kozloduy units 1-4 beyond 1997/1998 did not strictly amount to a clear-cut violation of the terms of the NSA agreement. Although the NSA and other Western countries and institutions protested vehemently against Sofia's decision, they reluctantly accepted the fact that the Bulgarian government would not close Kozloduy units 1-4 in line with the agreement's original schedule.

Why were the conditions laid down in the NSA agreement not met? According to the Bulgarian government, this outcome was due to the reluctance of IFIs to timely provide a sufficient amount of funds for the rehabilitation of Bulgaria's energy sector. In the following it is argued that this assessment is only partly correct, and that the deeper reason why the terms of the NSA agreement were not met was the Bulgarian government's desire to keep Kozloduy units 1-4 in operation as long as possible.

To begin with, it must be emphasized that the failure to meet the terms of the NSA grant agreement cannot be attributed to a principal lack of willingness on the part of IFIs to extend loans for the rehabilitation of Bulgaria's energy sector, at least not with respect to the conventional power projects envisaged by the NSA agreement. Indeed, both the EBRD and

the World Bank were prepared to facilitate the premature closure of Kozloduy units 1-4 by preparing and approving loans for a number of conventional power projects that were expected to improve Bulgaria's overall energy situation. Whereas the EBRD had provided loans in the order of ECU 39.5 million for upgrade work at the Maritza East II thermal power plant, the World Bank had approved an Energy-I loan worth $93 million for the construction of the Chaira pumped-storage hydroelectric power plant.[7] In addition, various IFIs had prepared a number of energy investment projects and considered to provide the necessary financial resources. The EBRD prepared together with the European Investment Bank (EIB) the so-called Power Sector Refurbishment Project which was slated to provide around ECU 60 million in financing for the refurbishment of the Maritza East III thermal power plant, the upgrading of Bulgaria's inefficient transmission and distribution network, and the initiation of a demand-side management program in the National Electric Company (NEK). Furthermore, the EBRD and the EIB also considered to jointly finance the so-called Power Transmission Project whose purpose was to support the restructuring and commercialization of the Bulgarian power sector, and to assist in preparations to link Bulgaria's transmission system to Western Europe's electricity grid. In addition, the World Bank and the EBRD considered jointly providing around $270 million in financing for the refurbishment and conversion of the Sofia and the Pernik district heating plants. Finally, the World Bank also reportedly considered extending an Energy-II loan in the order of $220 million for the refurbishment of the Varna thermal power plant.[8]

In contrast to the conventional power projects, finding an international lending facility willing to fund the then estimated $300 million modernization work at Kozloduy units 5-6 proved to be far more troublesome. After much wavering the EBRD eventually declined to finance the modernization project. As a result, it took until August 1995 for the Bulgarian authorities to approach Euratom—one of the few remaining lending facilities in principle willing to finance the modernization of Kozloduy units 5-6—with a loan application (Frogatt 1999). Following a protracted tendering process throughout 1997, the Bulgarian government announced in January 1998 that an international consortium called "Euroconsortium", comprising the German nuclear engineering firm Siemens, France's Framatome and several Russian nuclear organizations, had been selected to modernize Kozloduy units 5-6 (EEE

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[7] The last stage of the upgrade work at Maritsa Istok II was reportedly completed in late 1999. The Chaira pumped-storage hydroelectric power plant was finally operational in June 1999, i.e. two years behind schedule (PEE, 5 August 1999: 14; EEE Report, September 1999: 20-21).

Report, January 1998: 19-20). Euroconsortium's comprehensive modernization project was then expected to take about 4-5 years and to cost around ECU 230 million. Loan financing was due to come from consortium member countries, with a major contribution from Russia (around $150 million). Almost all of the upgrade work to be conducted by Siemens and Framatome was expected to be funded by Euratom loans under eased conditions. As part of the overall modernization project, the U.S. firm Westinghouse was chosen by the Bulgarian government to upgrade the computer systems at Kozloduy units 5-6. Westinghouse's upgrade project was slated to cost around $63 million, and was expected to be financed with loans from the U.S. Eximbank.

As pointed out above, the various energy projects envisaged by the NSA agreement were not completed on schedule partly because the various IFIs involved in the rehabilitation of Bulgaria's energy sector had failed to provide the necessary financial resources on time. What accounts for the delays on the part of IFIs to approve loans for the restructuring of Bulgaria's energy sector? Part of the answer is that although the IFIs were in principle willing to help Bulgaria refurbish its energy sector, they were not willing to do so at any price. In exchange for loans slated for the rehabilitation of Bulgaria's conventional power plants, both the EBRD and the World Bank insisted on a number of far-reaching conditions the Bulgarian government was expected to comply with. These conditions, ranging from the achievement of significant progress in the privatization of the Bulgarian energy sector, the abolishment of subsidies and elimination of loss-making state firms, to the lifting of price controls for energy, were basically designed to promote Bulgaria's problematic transition to a market-oriented economy, on the one hand, and to secure the future repayment of disbursed loans, on the other. In the course of the 1990s, the IFIs involved in Bulgaria became increasingly adamant in their demands that Sofia meet such conditions before new energy projects were approved for financing, and even threatened to withhold already contracted loans if the Bulgarian government failed to make progress in its reform program.

The lack of movement on electricity prices proved to be the most irksome issue in this respect. Despite sharp price increases in 1991 and every six months thereafter, the rates paid by Bulgarian electricity consumers failed to meet production costs in subsequent years. In 1995 the issue came to a head as both the World Bank and the EBRD demanded that the Bulgarian government immediately increase electricity prices (EEE Report Profiles, 1995a:

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[8] For a detailed description of these energy projects, see websites of the EBRD and the World Bank.

16). The Bulgarian government was initially reluctant to comply with these demands because of the possible social and political consequences of such measures.[9] But faced with the threatened suspension of loans for its energy sector, Sofia eventually gave in and agreed to comply with such requirements. Although electricity prices nearly reached production-cost levels by late 1996, Bulgaria's plunging currency during the subsequent months of political chaos and social unrest essentially meant that in dollar terms electricity prices had once again dropped far below the rates demanded by IFIs. IFIs subsequently maintained that further loans for Bulgaria's energy sector would remain conditional upon Sofia reforming the country's energy sector and increasing electricity prices. As a result, by the time the various power replacement projects should have been completed according to the NSA agreement neither the EBRD nor the World Bank had taken a positive funding decision on those conventional power energy projects then under consideration.

Similar reasons account for the problems in securing a source of finance for the modernization of Kozloduy units 5-6. It was originally expected that the EBRD would finance the project (EEE Report, July 1993: 12-13). However, the slow progress achieved by the Bulgarian government in restructuring the country's energy sector and increasing electricity prices no doubt deterred the bank from allotting substantial sums for the modernization of the two VVER-1000 units. Moreover, as a result of its evolving fiasco in the Mochovce nuclear completion project in the Slovak Republic (see case study III), the EBRD had become deeply critical of financing completion and modernization work at Eastern NPPs. With two major IFIs either reluctant (the EBRD) or not able (the World Bank)[10] to finance the modernization work at Kozloduy units 5-6, it was obvious that the project would run into financing difficulties and, consequently, be delayed. Indeed, only in August 1995 had Euratom been approached to consider funding the modernization project, i.e. only a few months before the upgrade work at Kozloduy units 5-6 had been scheduled to begin. And since it had become increasingly evident in the following months that the various power replacement projects envisaged by the NSA agreement would not be completed on schedule, which in turn was

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[9] The Bulgarian government was reportedly concerned that energy price increases would contribute to inflation and effectively push the country's metallurgical and chemical industries towards collapse (EEE Report, July 1995: 24). However, a study carried out by the World Bank in 1995 claimed that the Bulgarian authorities were exaggerating the implications of power price increases for inflation. Since the electricity expense accounted for only 2.6 percent of the average total household expenses, it was estimated that even a 50 percent increase in power prices would raise the consumer price index only by 1.25 percent (World Bank 1999: 34).

[10] Since the 1980s, the World Bank's official lending policy is not to finance nuclear power projects, both on environmental and economic grounds (Friends of the Earth 1992: 18-19).

likely to jeopardize the closure of Kozloduy units 1-4 in 1997/98, the European Commission was reluctant to commit Euratom loans without a definitive closure schedule on the table.

In short, the reluctance of IFIs to attach less harsh conditions to their loans and, consequently, to jeopardize their own interests, i.e. in particular their desire to secure the repayment of disbursed loans, for the sake of meeting the terms of the NSA agreement, may have resulted in the proposed investments in the Bulgarian energy sector being delayed. On the other hand, and in defense of the uncompromising stance of the IFIs, it must be emphasized that the Bulgarian government needed to be encouraged to introduce market reforms into the country's ailing power sector. Although socially painful and thus politically dangerous to the Bulgarian government, market reforms were the only practicable way to correct distorted economic incentives, improve the cash flow of the energy sector, and to ultimately secure an efficient energy supply in Bulgaria. Hence the lack of political will on the part of the Bulgarian leadership to follow through with admittedly painful, nevertheless inevitable market reforms of the country's power sector certainly contributed to the slow disbursement of loans from IFIs for the designated energy projects in Bulgaria.

As mentioned above, a deeper reason why the terms of the NSA agreement were not met on schedule was the Bulgarian government's desire to keep Kozloduy units 1-4 in operation as long as possible. As a matter of fact, it is not unreasonable to assume that the Bulgarian officials deliberately dragged their feet in negotiations with the NSA and other IFIs in order to prevent the NSA closure schedule from being met. The following observations lend support to the assumption that the Bulgarian government was reluctant to take the necessary steps towards the premature closure of Kozloduy units 1-4. To begin with, already in 1995, i.e. less than two years after the conclusion of the NSA agreement and two to three years prior to the anticipated closure of Kozloduy units 1-4, the Bulgarian government had begun to signal that it would not be able to abide by its closure commitments. Moreover, the grounds on which Yanko Yanev, chairman of the Bulgarian nuclear safety authority, was dismissed from his post in August 1996 further suggest that the Bulgarian government was unwilling to consider closing Kozloduy units 1-4 in the near future. Yanev, who had led the Bulgarian delegation in negotiations with the NSA/EBRD in 1993, was fired because he had agreed both to the early closure of Kozloduy units 1-4 as a condition of the NSA grant agreement and to the temporary shutdown of Kozloduy unit 1 in May 1996 to test its pressure vessel (Nuclear Energy Institute 1997: 313).

Furthermore, the Bulgarian government proved to be strikingly slow in approving a long-term energy investment plan that was designed to specify the investments by which the planned shutdown of Kozloduy units 1-4 could be facilitated. Indeed, over two years after the NSA agreement had been concluded, the EBRD was reportedly still engaged in negotiations with Sofia over the introduction of a least-cost plan for the country's energy sector (NW, 23 December 1993: 5; NW, 6 April 1995: 11-12; NW, 5 October 1995: 4-5). This had been a matter of serious concern to the NSA since the Bulgarian government's uncooperative behavior on the issue had served to dim the prospects that the planned energy projects would be in place by the time Kozloduy units 1-4 were expected to be shut down.[11] Finally, the irritated reaction of the Bulgarian government to the conclusions of a Western-led study of the operating records of the Kozloduy NPP in 1996 also indicates that Sofia had no intention to prematurely close Kozloduy units 1-4. The Western-led study revealed that Kozloduy units 5-6 had been operating in the past far below full capacity and hence concluded that Bulgaria could absorb the closure of one or possibly even two older Kozloduy units simply by running the more modern VVER-1000 units of the Kozloduy NPP nearer their full capacity (EEE Report, March 1998: 1-3). The study effectively refuted the often-repeated claim by Bulgarian officials that the power from all six Kozloduy units was desperately needed to meet domestic power needs. However, the Bulgarian government firmly rejected the conclusions of the study on the grounds that Western officials had cooked up the data in order to coerce Bulgaria into shutting down the older reactors of the Kozloduy NPP. In short, it is not impossible that the Bulgarian government deliberately hindered the scheduled implementation of the designated energy projects in order to be free to prolong the operation of Kozloduy units 1-4 beyond the closure dates stipulated by the NSA agreement.

What accounts for the Bulgarian government's resolve to disregard its obligations under the NSA agreement and to prolong the service lives of Kozloduy units 1-4? To begin with, Sofia's stance was strongly determined by the fact that the economic imperative to keep Kozloduy units 1-4 in operation had grown significantly since the time the NSA agreement had been concluded. As a consequence of the relatively high costs of domestically produced coal and imported fossil fuels, Bulgaria had gradually increased its reliance on nuclear power from 37 percent in 1993 to around 45 percent in 1997. The growing relative importance of

[11] The option to coerce the Bulgarian government into agreeing on an energy investment plan by withholding further grants for the safety upgrade program was, however, dismissed by NSA officials on the grounds that the NSA's main objective remained the near-term improvement of these four units' safety (NW, 5 October 1995: 5).

nuclear power for the country's electricity supply certainly increased the perceived costs of prematurely closing Kozloduy units 1-4. Moreover, the Bulgarian authorities had predicted that domestic electricity demand would soon recover after a long period of decline, a prediction that further strengthened the economic case of keeping Kozloduy units 1-4 in operation (EEE Report, March 1998: 1-3). Furthermore, by 1996 a number of energy-poor countries in the region such as Greece, Turkey and the former Yugoslavia had expressed their interest in purchasing cheap electricity from Bulgaria, which in turn added to the economic value of the Kozloduy NPP (Nuclear Energy Institute 1997: 311-312; NW, 11 December 1997: 13-14). Indeed, due to the past years of steadily decreasing domestic electricity demand, Bulgaria had enjoyed a dramatic reduction in power imports and a concomitant rise in exports: Whereas in 1992 Bulgaria had imported 3'270 GWh of electricity and exported only 566 GWh, this negative trade balance had been completely reversed by 1997, with electricity imports totaling 785 GWh and annual exports amounting to 4'335 GWh (EEE Report, April 1999: 8).

In addition, the provision of Western nuclear safety assistance, in particular the grants provided by the NSA for the installation of safety-enhancing equipment at the Kozloduy NPP, no doubt enhanced the incentives and capacities of the Bulgarian government to keep Kozloduy units 1-4 in operation beyond the anticipated closure dates. Indeed, the successful implementation of various safety upgrade projects did not only allow the Bulgarian government to argue that there were no longer any reasons to prematurely close Kozloduy units 1-4 on safety grounds, but also made the prolonged operation of Kozloduy units 1-4 both technically and financially more feasible (NEI, May 1998: 3). Furthermore, Bulgarian officials claimed that after safety upgrade work worth around $100 million had been conducted at the Kozloduy NPP, it made no economic sense to prematurely shut down Kozloduy units 1-4. Indeed, Sofia maintained that it would be significantly cheaper to invest in further safety upgrades at Kozloduy units 1-4 and to allow them to operate until the end of their service lives than to spend millions of dollars on the provision of conventional power replacement capacity (EEE Report, November 1997: 9-10).[12] Furthermore, the Bulgarian government argued that the continued operation of the four upgraded VVER-230 units was

[12] This argument lends support to the assumption that the Bulgarian authorities were not especially interested in the timely implementation of the various energy projects envisaged by the NSA agreement. Indeed, although Bulgaria's aging thermal power plants needed to be revamped, the Bulgarian authorities probably reckoned that it made more (narrow) economic sense to postpone the expensive task of restructuring the country's energy sector for some time in order to be free to continue operating Kozloduy units 1-4 which provided cheap electricity.

needed to generate the funds for the eventual decommissioning of Kozloduy units 1-4, then estimated by the Bulgarian authorities to cost about $800 million (EEE Report, December 1997: 9-10).

Finally, repeated bids by the Russian nuclear industry and government to modernize Kozloduy units 1-4 for extended operations most likely encouraged the Bulgarian government to develop plans to prolong the service lives of these units. Already in November 1995 the Russian nuclear industry, which was eager to keep Bulgaria as an important export market for its nuclear fuel and technology and to secure upgrade contracts, had offered to help the Bulgarian authorities to further modernize Kozloduy units 1-4. In late 1996, the Russian government offered to extend a "commodity credit" worth around $250 million to fund modernization work at these four units (EEE Report, November 1995: 6; NucNet, 2 December 1996; NN, January 1997: 35). In addition, Russia's aggressive bidding practices had the effect of prompting other Western nuclear firms to consider getting involved in any modernization work at Kozloduy units 1-4, thereby undermining the previous restraint on the part of various Western nuclear firms to conduct life extending safety upgrades on these units. Indeed, by late 1997 the German nuclear engineering firm Siemens was working on the development of a long-term safety improvement program for Kozloduy units 1-4 and was reportedly also involved in talks with NEK to discuss the possibility of life extension measures (NW, 11 December 1997: 12).

With various energy investment projects far behind schedule and the Bulgarian authorities apparently reluctant to close Kozloduy units 1-4 in the near future, the whole NSA closure deal was on the verge of collapse by early 1998. Indeed, the Bulgarian government was at the time preparing an extensive upgrade program for Kozloduy units 1-4 which would allow these units to operate until the end of their useful design lives or even beyond. The NSA/EBRD, on the other hand, reluctantly accepted the fact that Bulgaria would continue to operate these upgraded, nevertheless still unsafe nuclear reactors, at least until additional replacement power was in place, which at the time was expected to take years. Although EBRD officials continued to negotiate with the Bulgarian authorities throughout 1998, it had become increasingly clear that they would not be able to induce the Bulgarian government to establish revised closure schedules. Aware of the risk that Bulgaria was likely to further upgrade Kozloduy units 1-4 for extended operations, the European Commission effectively took over closure negotiations from the NSA/EBRD in September 1998 and made it clear to Sofia that Bulgaria's EU membership prospects depended on the premature closure of these

four units. Since the efforts by the European Commission to secure the premature closure of Kozloduy units 1-4 are analyzed in Case Study IV, the following assessment of the NSA's closure deal with Bulgaria is limited to early 1998.

4.4 Assessment

To which extent did Bulgaria change its externality-generating behavior in a direction desired by the Western donors? On the basis of the 1993 NSA grant agreement, the Western donors sought to induce and enable the Bulgarian authorities to both improve safety levels at the four VVER-230 units of the Kozloduy NPP and to definitively close Kozloduy units 1-4 in 1997/1998. The Western donors' goal of reducing and—after a specified time period—of eliminating the risk of a nuclear accident at the Kozloduy NPP was only partly achieved. On the positive side, the somewhat delayed implementation of the NSA-funded safety upgrade program had reduced to a certain extent the risk of a nuclear accident at the Kozloduy NPP. On the negative side, the Bulgarian government ultimately refused in 1998 to comply with its NSA closure commitments and announced plans to extend the service lives of Kozloduy units 1-4. In short, the behavioral changes on the part of Bulgaria encompassed a risk-reduction through the implementation of the safety upgrade program, but no risk-elimination due to the Bulgarian government's refusal to prematurely close Kozloduy units 1-4.

Which cooperation strategies and what kind of measures were employed by the Western donors to influence Bulgaria's behavior? The Western donors sought to secure risk-reducing and ultimately risk-eliminating behavioral changes on the part of Bulgaria by a combination of the following two cooperation strategies. To begin with, the Western donors employed *normative strategies*. At various rounds of negotiations and talks, NSA/EBRD officials and other Western nuclear safety experts had tried to persuade the Bulgarian authorities to adopt higher nuclear safety standards and to prematurely close Kozloduy units 1-4 on safety grounds. The provision of *positive incentives* was the Western donors' predominant cooperation strategy. Positive incentives were employed for the following measures. The NSA provided ECU 24 million in grants for near-term technical safety upgrades at Kozloduy units 1-4. In addition, it was foreseen by the NSA agreement that IFIs such as the EBRD and the World Bank would provide an unspecified amount of favorable loans to rehabilitate Bulgaria's energy sector and to provide sufficient power replacement capacity in order to facilitate the premature closure of Kozloduy units 1-4.

To which extent was the observed behavioral change on the part of Bulgaria influenced by the provision of positive incentives and how high was the effectiveness of the transaction? The observed behavioral change on the part of Bulgaria was almost exclusively attributable to the provision of positive incentives. Indeed, the employment of normative strategies, while possibly enhancing the Bulgarian government's willingness to carry out safety upgrades, affected the final outcome at most only slightly. Since the transfer of positive incentives resulted in reduced risk-levels at the Kozloduy NPP, but ultimately failed to secure the premature closure of Kozloduy units 1-4, the *effectiveness* of the examined transaction was rather low.

How high was the efficiency of the transaction? *First dimension of efficiency*: The provision of positive incentives was certainly efficient in the sense that no alternative cooperation strategy could have led to comparable or superior behavioral changes on the part of Bulgaria at a lower or comparable cost. Positive issue-linkage strategies were unlikely to be more cost-effective than positive incentive strategies for two reasons. To begin with, positive issue-linkage strategies do not directly address incapacities on the part of the recipient country, but rather seek to enhance the recipient's incentives to cooperate. Hence while such strategies could have been used to increase the Bulgarian government's incentives to prematurely close Kozloduy units 1-4, they could not have been usefully employed to enable the Bulgarian authorities to enhance safety levels at the plant or to develop power replacement capacity. Second, it is rather doubtful whether the Western donors could have at the time identified or agreed on a specific issue-linkage capable of generating large enough incentives to induce the Bulgarian government to comply with Western closure demands. For example, the option of linking Bulgaria's EU membership prospects to a cooperative stance on the closure issue was not possible due to the fact that at the time Bulgaria had not yet formally applied for EU membership and in any event could not count on having a prospective membership application accepted in the near future.

Similar reasons explain why negative incentives were unlikely to be more cost-effective than positive incentives. Economic sanctions were unlikely to entice the Bulgarian government to develop the technical and financial means to improve the safety of the Kozloduy NPP or to construct additional electricity generation capacity needed to compensate for the power lost by the plant's premature closure. Moreover, while the threat or imposition of economic sanctions would have enhanced Bulgaria's perceived costs of not complying with Western closure demands, it is doubtful whether such measures would have been

sufficient to induce the Bulgarian government to cooperate. As a matter of fact, the imposition of economic sanctions risked being counterproductive by exacerbating Bulgaria's problem-ridden transformation process and thereby possibly forcing the hard-pressed country to rely even more heavily on the cheap power produced at the Kozloduy NPP. In addition, it is doubtful whether the Western countries would have been prepared to bear the potential costs involved in coercing Bulgaria into complying with Western nuclear safety demands. Indeed, the West was unlikely to put at risk its economic and political interests in a smooth transformation process for the sake of securing the premature closure of Kozloduy units 1-4. Finally, under the given circumstances it was highly unlikely that the employment of cognitive or normative strategies would have resulted in a more favorable outcome from the Western donors' point of view.

Second dimension of efficiency: The transaction involved potentially serious inefficiencies in the sense that alternative ways of employing positive incentives may have resulted in superior behavioral changes on the part of Bulgaria at a comparable cost. The Western funding strategy encompassed the provision of NSA grants for near-term technical safety upgrades at Kozloduy units 1-4 and the disbursement of an unspecified amount of loans by IFIs for the rehabilitation of Bulgaria's energy sector. The analysis of the transaction has shown that the implementation of near-term safety upgrades at the four VVER-230 units of the Kozloduy NPP did not only discourage the Bulgarian authorities from making rapid progress in the restructuring of the country's ailing energy sector, but also ultimately enhanced the incentives and capacities of the Bulgarian government to keep the four upgraded, nevertheless still unsafe units in operation beyond the scheduled closure dates. As such the specific way the Western donors chose to employ positive incentives effectively resulted in prolonging the transboundary threat posed by the Kozloduy NPP, albeit at somewhat lower levels of risk. It is hence not impossible that the Western donors could have secured larger and more lasting safety benefits by refraining from funding technical safety upgrades at Kozloduy units 1-4 and instead channeling *all* available financial and technical assistance towards the rehabilitation of Bulgaria's energy sector and the promotion of energy efficiency schemes. Such an alternative funding strategy would have probably been more successful in creating the material conditions for the premature closure of Kozloduy units 1-4, and would have certainly also avoided the risk of encouraging and enabling the Bulgarian government to prolong theses units' service lives. True, in pursing such an alternative funding strategy the Western donors would have probably had to endure higher levels of risk in the

short-term. However, in the mid- to long-term the funding of such alternative capacity-building measures promised to be the most cost-effective way to secure the premature closure of Kozloduy units 1-4 and thus a satisfactory and lasting solution to the nuclear safety problem in Bulgaria. In short, the efficiency of the transaction (second dimension) was rather low.

To which extent did the theoretically predicted problems in designing and implementing positive incentives shape the effectiveness and efficiency of the transaction? *Extortion and moral hazard problems* did not negatively affect the outcomes to be explained. Indeed, the Bulgarian government did not engage in extortion in the sense that it threatened to enhance or prolong the risk of a nuclear accident at the Kozloduy NPP unless the Western donors provided a specific amount of resources. Rather, Sofia simply signaled to the Western donors, and rather credibly so, that it lacked the financial and technical capacities to reduce and/or eliminate the risk of a nuclear accident at the Kozloduy NPP. As such there are no reasons to assume that the Bulgarian government bluffed the Western donors into providing the resources for a behavioral change—reducing and/or eliminating the risk of a nuclear accident at Kozloduy units 1-4—it would have undertaken even without having received any resources. Nor did the analysis uncover any compelling evidence that the Bulgarian government engaged in moral hazard behavior. Indeed, it is rather unlikely that the prospect of gaining Western nuclear safety assistance induced the Bulgarian authorities to accept higher levels of nuclear risk at the Kozloduy NPP and to refrain from investing their own resources to alleviate the nuclear safety problem. In addition, these two potential problems in designing and implementing positive incentives did not discourage the Western donors from engaging in a transaction with the Bulgarian government.

Information and distribution problems did not negatively affect the effectiveness of the transaction. Two reasons explain why negotiations between the NSA/EBRD and the Bulgarian government on a closure deal were concluded after a relatively short period of time and without much haggling over the costs and benefits of cooperation. First, it did not make sense for the Bulgarian government to bargain for extensive compensation since the financial resources of the NSA were in any case limited. Moreover, the NSA closure agreement had been phrased in ways—in particular the clause foreseeing closure of Kozloduy units 1-4 only after sufficient power replacement capacity had been provided—so as to allow the Bulgarian authorities room for maneuver in complying with future closure commitments.

The effectiveness of the transaction was to a certain extent hampered by *enforcement problems*. To begin with, the dismal safety situation at the Kozloduy NPP deterred the NSA from withholding grants for the safety upgrade program to induce the Bulgarian authorities to cooperate regarding the implementation of those provisions of the grant agreement designed to secure the premature closure of Kozloduy units 1-4. Moreover, once the grants earmarked for the implementation of the near-term safety upgrades at Kozloduy units 1-4 had been disbursed, the NSA had no leverage left to ensure that the Bulgarian government complied with its commitments under the NSA grant agreement. Finally, the NSA had no control over the long-term investment activities of the EBRD and the World Bank, both of which proved unwilling to suspend or withhold loan financing and assistance programs to induce the Bulgarian government to comply with its commitments.

The efficiency of the transaction was seriously affected by the specific *problem-definition* adopted by the Western donors. In determining potential measures to address the safety threat posed by the continued operation of Kozloduy units 1-4, the Western donors adhered to a rather pro-nuclear problem-definition. Indeed, even though the NSA closure agreement foresaw the provision of an unspecified amount of loans for the rehabilitation of Bulgaria's energy sector—which promised to be the most cost-effective funding strategy to secure a lasting solution to the nuclear safety problem in Bulgaria—, the main thrust of the Western response to the nuclear safety problem in Bulgaria involved the funding and implementation of near-term technical safety upgrades at Kozloduy units 1-4. This pro-nuclear bias in the Western donors' funding strategy, although to a certain degree justifiable due to the urgency "to do something" about the dismal safety situation at Kozloduy units 1-4, was strongly determined by the commercial and political interests of the Western nuclear industry and their governmental supporters. Indeed, since Western nuclear engineering firms hoped to benefit commercially from subsidized safety upgrade work at Eastern NPPs, they used their considerable political weight—nuclear utilities and suppliers are generally very large, well-organized, often state-owned, and thus politically influential—to lobby their respective governments into providing assistance for quick, technical solutions to the nuclear safety problem in Bulgaria. Various Western governments, on the other hand, perceived the provision of financial assistance for such technical measures as a politically convenient way to subsidize and support their ailing nuclear industries. Hence, due to the specific interests of the Western nuclear industry and various pro-nuclear Western governments, the Western

donors adopted a problem-definition that in effect thwarted the employment of a potentially more cost-effective funding strategy.

The effectiveness of the transaction was seriously hampered by the *"slippery slope effect"*. Indeed, the successful implementation of the NSA-funded safety upgrade program had the effect of both encouraging and enabling the Bulgarian government to keep Kozloduy units 1-4 in operation beyond the scheduled closure dates. The externally financed installation of various safety-enhancing equipment at the four VVER-230 units did not only make the continued operation of Kozloduy units 1-4 technically more feasible and economically more profitable, but also allowed the Bulgarian authorities to argue that the achieved safety improvements had removed all cause for concern about prolonging the service lives of these units.

The effectiveness of the transaction was also negatively affected by *coordination problems* among the donors. One coordination problem took place between the NSA, on the one hand, and the IFIs expected to provide loan financing for the various energy projects designated by the NSA agreement, on the other. In the course of the 1990s, these IFIs proved to be increasingly adamant in their demands that loans earmarked for these energy projects be attached to far-reaching market reforms in the Bulgarian energy sector, not least in order to ensure the repayment of disbursed loans. The Bulgarian authorities, however, were often unwilling for political and economic reasons to implement the requested market reforms, which in turn prompted the IFIs to withhold already approved loans and to delay consideration of other energy investment projects. In addition, the growing reluctance of the EBRD to fund nuclear upgrade and completion projects—at least in part a consequence of the bank's dismal experiences with its Mochovce nuclear completion project in the Slovak Republic—seriously delayed the scheduled modernization work at Kozloduy units 5-6. More flexibility and an easing of loan conditions on the part of the IFIs may have resulted in the designated energy projects being implemented on schedule. As such, the failure to secure the premature closure of Kozloduy units 1-4 may be partly attributed to the fact that IFIs were entrusted with fulfilling a major part of the conditions stipulated by the NSA agreement, and that these IFIs proved to be reluctant to subordinate their own interests to the NSA goal of securing the premature closure of Kozloduy units 1-4. However, it should be noted that market reforms were in effect necessary to restructure Bulgaria's ailing energy sector and to improve energy efficiency. In addition, the Bulgarian authorities proved to be rather uncooperative in loan negotiations with IFIs.

Another coordination problem took place among those potential donor countries and firms capable of financing and conducting modernization work at Kozloduy units 1-4. Indeed, although Kozloduy units 1-4 were scheduled for closure in 1997/1998, the Russian nuclear industry, backed by loans from the Russian government, repeatedly offered to upgrade these units for prolonged operation. These aggressive Russian bids did not only strengthen the Bulgarian government's resolve to keep these units in operation as long as possible, but also eroded the previous restraint on the part of Western nuclear firms to consider conducting life-extending modernization work at Kozloduy units 1-4.

5 CASE STUDY II: THE NSA'S CLOSURE DEAL WITH LITHUANIA

Following Lithuania's independence from the Soviet Union in September 1991, various Western countries had sought to reduce the risk of a nuclear accident at the two inherently unsafe RBMK units of the Ignalina NPP and to persuade the Lithuanian authorities to prematurely close the plant. In February 1994 the NSA concluded a grant agreement with the Lithuanian government. According to the terms of the 1994 agreement, the NSA agreed to provide around ECU 40 million in grants for near-term technical safety upgrades at the Ignalina NPP and an in-depth safety assessment and IFIs would extend an unspecified amount of loans for the rehabilitation of Lithuania's energy sector in exchange for a commitment on the part of the Lithuanian government to prematurely close the Ignalina NPP. Specifically, the Lithuanian government pledged to close the two RBMK units by the time they required rechanneling, then estimated to be around 1999-2002 for Ignalina unit 1 and before 2010 for Ignalina unit 2. In addition, the Lithuanian government agreed to close Ignalina unit 1 by mid-1998 provided that the continued operation of this unit was not economically justified and the Lithuanian Nuclear Safety Authority refused to re-license the unit on safety grounds. While the NSA-funded safety upgrade program was successfully implemented, it had become evident by early 1998 that the Lithuanian government was unwilling to comply with the terms of the NSA agreement and was planning to rechannel the two RBMK units for prolonged operation.

The outcomes to be explained can be summarized as follows. *Effectiveness*: Since the transfer of positive incentives reduced to a certain extent the risk of a nuclear accident at the Ignalina NPP, but was unlikely to secure the premature closure of the plant, the effectiveness of the transaction was rather low. *Efficiency*: Whereas the employment of no other cooperation strategy could have secured a comparable or superior behavioral change on the part of Lithuania at a lower or comparable cost, it is not impossible that other ways of employing positive incentives could have done so. As such the efficiency of the transaction (second dimension) was rather low. These outcomes were shaped by the following problems. While the effectiveness of the transaction was seriously hampered by the "slippery slope effect" and by enforcement problems, the rather pro-nuclear problem-definition adhered to by the Western donors impinged on the efficiency of the transaction (second dimension).

The case study on the NSA's closure deal with Lithuania is structured along the following lines. The first section explores the energy situation in Lithuania and discusses why

it was difficult, if not impossible, for the Lithuanian government to unilaterally alleviate the nuclear safety threat posed by the continued operation of the Ignalina NPP. The second section describes the provisions of the 1994 NSA grant agreement and explains why a closure agreement was concluded despite reservations on both sides. The third section examines the implementation of the agreement and elaborates on the reasons why the Lithuanian government was unwilling to comply with the terms of the NSA agreement. The fourth and final section summarizes the results of the case study.

5.1 The Energy Situation in Lithuania

Prior to gaining national independence in September 1991, Lithuania had been part of the Soviet North-Western power system. During the 1980s the Soviet authorities had installed considerable electricity generation capacity in Lithuania, in particular the two RBMK units of the Ignalina NPP, to cover regional electricity demand, i.e. for the region now encompassing the independent states Lithuania, Latvia, Belarus and the Kaliningrad area.[1] Due to the decision by Soviet energy planners to concentrate regional power supply in the Lithuanian Soviet Republic, Lithuania had far more power generating capacity than it required to satisfy domestic electricity demand after it had become an independent state (Ebel 1997: 213). The two RBMK units of the Ignalina NPP (2'500 MW, net), along with the Elektrenai thermal power plant (1'800 MW, net) make up the core of Lithuania's power generating capacity, with the rest coming from various central heating plants (CHP) and small hydroelectric facilities.

TABLE 5.1: LITHUANIAN POWER GENERATING CAPACITY

Source	**Capacity (MW, Net)**	**Percent of Total Power Generating Capacity**
Thermal	2'609	45
Nuclear	2'500	43
Hydroelectric	711	12
Total	5'820	100

Note: For safety reasons, the totally installed capacity of 3'000 MW at the Ignalina NPP was reduced in April 1991 to 2'500 MW. Source: Ebel 1997: 213.

[1] The Soviet authorities had originally planned to construct four RBMK units at the Ignalina NPP, but only two were completed—Ignalina unit 1 was commissioned in December 1983 and Ignalina unit 2 in August 1987. Construction of the third and fourth reactor was halted in 1989 due to the widespread public opposition to nuclear power in the wake of the Chernobyl accident (Frogatt 1999).

Following the dissolution of the Soviet Union, Lithuania and the other newly independent states in the region entered a period of sustained economic contraction, accompanied by a sharp fall in industrial output. The resulting decline in both domestic and regional electricity demand led to a significant reduction in power production in Lithuania, from a total 29.4 billion KWh in 1991 to 10 billion KWh in 1994. In tandem with the reduced regional power demand, Lithuanian electricity exports dropped dramatically from 12 billion KWh in 1990 to about 1 billion KWh in 1994.

TABLE 5.2: LITHUANIAN ELECTRICITY GENERATION AND EXPORTS (SELECTED YEARS)

Year	Generation (in billion KWh)	Exports (in billion KWh)	Exports as a percentage of total power generation
1990	28.4	12.0	42.3
1993	14.7	2.7	18.4
1994	10.0	1.1	11

Source: Ebel 1997: 214.

The demise of the Soviet Union had far-reaching implications for the role of nuclear power in Lithuania. Since Lithuania has little or no domestic coal, crude oil, or natural gas reserves, Moscow had supplied the Lithuanian Soviet Republic with energy sources at highly subsidized rates (IEA 1994: 128). Following the break-up of the Soviet Union, however, Russia was no longer willing to provide cheap energy supplies to the newly independent republic and demanded ever-increasing prices for its energy exports. Lithuania responded to the price hikes for fossil fuels imported from Russia and to the decline in domestic electricity demand by idling thermal power capacity, which in turn led to an increased relative importance of nuclear power. This policy response was certainly rational in economic terms: Since the most expensive component of nuclear power, i.e. the capital costs, could be written off by virtue of Lithuania having effectively inherited the Ignalina NPP, the costs of producing nuclear power were estimated to be around 50 percent lower than the costs of generating electricity at the country's thermal power plants. The relative economic advantage of nuclear power induced Lithuania to increase the amount of electricity generated at the Ignalina NPP as a percentage of total power production from 57.9 percent in 1991 to around 88 percent in 1993, thus making Lithuania the world's most dependent country on nuclear energy (Ebel 1997: 215-216).

In short, in the course of the early 1990s nuclear power had assumed a unique role in Lithuania: The Ignalina NPP did not only satisfy an overwhelming part of the country's

power demand, but also had a considerable export potential, even though power exports had collapsed following the disintegration of the Soviet Union. In addition, the Ignalina NPP secured a certain degree of energy independence from Russia that in the past had not hesitated to suspend fossil fuel deliveries to apply political pressure. Indeed, Moscow had responded to Lithuania's March 1990 unilateral declaration of independence from the Soviet Union by cutting off fuel supplies for ten weeks (Ebel 1997: 202). Moreover, in February 1991 the Soviet leadership had canceled oil shipments as a means to counter the growing national separatism in the Lithuanian Soviet Republic. As a result of these efforts by Moscow to exploit Lithuania's energy dependence, the former large-scale public opposition in Lithuania to the continued operation of the Ignalina NPP—once despised as a symbol of Moscow's domination of the republic and its disregard for local sensitivities and safety—disappeared for good (Launer and Young 1997: 50). Although the Ignalina NPP was of considerable economic and political value to the newly independent country, the Lithuanian authorities were most likely aware of the safety risks posed by the continued operation of the two RBMK units. However, they were reluctant to immediately close the plant for the reasons outlined above, and also lacked the financial and technical means to alleviate the plant's safety deficiencies.

5.2 The NSA Agreement with Lithuania

The inherent safety deficiencies of the two operational RBMK reactors of the Ignalina NPP and their geographical proximity to Scandinavia and Western Europe had made the Ignalina NPP a priority item on the West's nuclear safety agenda. Various concerned countries, in particular Sweden, had been involved in improving the safety of the Ignalina NPP ever since Lithuania had become an independent state in September 1991. The work conducted under these early bilateral nuclear safety assistance programs was mainly "software-related" and focused on conducting studies of the plant's safety. By mid-1993, Lithuanian officials had drawn up in cooperation with Western nuclear safety experts a comprehensive plan to improve the safety of the Ignalina NPP, the so-called Safety Improvement Program (SIP) (NEI, June 1997: 26-28). After the Lithuanian nuclear safety authority (Vatesi) had approved the SIP, the Lithuanian government approached the NSA with a formal request for financing the safety upgrade program. To accelerate international funding for the SIP, the Lithuanian authorities made a significant effort to solve the pending nuclear liability issue which had previously hindered any hands-on work at the plant: In late 1993, the Lithuanian parliament

(Seimas) ratified the Vienna Convention and passed a nuclear law based on the wording of the convention. On 17 December 1993, the NSA's Assembly of Contributors tentatively approved an ECU 33 million (then about $40 million) grant for near-term safety upgrades at the plant. After the Lithuanian government had given its consent to the terms of the NSA grant, the agreement was signed on 10 February 1994.

As part of the overall safety improvement program, the appropriated NSA funds of ECU 33 million—later increased to ECU 34.8 million—were earmarked to support 20 safety projects in three areas (NEI, June 1997: 26-28): Operational safety, technical improvements, and services.[2] Completion of the NSA-funded safety upgrade projects was scheduled for 1998. The NSA also agreed to provide around ECU 7 million for an in-depth safety assessment of the Ignalina NPP.[3] In addition, the NSA agreement foresaw the provision of an unspecified amount of favorable loans by IFIs to rehabilitate Lithuania's energy sector. In exchange for the NSA grant, the Lithuanian government agreed to the following conditions (Nuclear Energy Institute 1997: 236):

- The operation of both RBMK units of the Ignalina NPP would not be prolonged beyond the time these units required rechanneling. Due to the deformation of the graphite moderator, RBMK reactors require rechanneling after 15-20 years of operation, i.e. about halfway through their useful service lives. At the time the NSA agreement was concluded, it was expected that Ignalina unit 1 would need to be rechanneled between 1999 and 2002, and the deadline for rechanneling Ignalina unit 2 was then estimated to be before 2010.
- An in-depth safety assessment of the Ignalina NPP under the supervision of a panel of international experts and partly funded by the NSA would be completed by the end of 1995.
- The continued operation of Ignalina unit 1 beyond mid-1998 would depend on Lithuania's energy situation and on the cost of further safety upgrades. If the continued operation of Ignalina unit 1 beyond mid-1998 was found to be economically justified, Vatesi, the Lithuanian nuclear safety authority, would determine whether the unit's continued operation could be justified on safety grounds and decide on a new Western-style

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[2] Operational safety improvements encompassed non-destructive examinations, seals for pressure tubes, routine maintenance equipment, radiation monitors and a simulator. Near-term technical improvements covered seismic, fire and explosion prevention. Services included project management as well as design and engineering work (Nuclear Energy Institute 1997: 237).

[3] Beyond the NSA grants, additional aid for the overall safety improvement program was expected to be provided by other Western donors, especially by Sweden ($8-10 million), as well as by Canada, the United States and Japan. Lithuania pledged to contribute $5 million annually to the safety improvement program (NucNet, 15 August 1995; Nuclear Energy Institute 1997: 237).

operating license for the unit by mid-1998. Vatesi's decision would be based on the results of the Western-funded in-depth safety assessment.

- The Lithuanian government would prepare a detailed investment program for the rehabilitation of the country's power sector. The NSA agreement with Lithuania stipulated that the premature closure of the two RBMK units was dependent on Lithuania having sufficient domestic electricity supply—excluding power export capacity (NW, 17 February 1994: 1). Least-cost loan investments by IFIs in Lithuania's energy sector were expected to enhance efficiency in both electricity production and consumption and thereby guarantee a sufficient electricity supply following the anticipated closure of the Ignalina NPP.

The NSA agreement with Lithuania was designed to provide for near-term safety improvements at the Ignalina NPP and ultimately sought to secure the early closure of the plant's two RBMK units. Taking into account that the terms of the agreement obliged the Lithuanian authorities to prematurely close the Ignalina NPP, the successful conclusion of the NSA agreement may be puzzling. Indeed, the NSA closure deal essentially consisted of a commitment on the part of the Lithuanian government to give up a both an economically and politically valuable asset in exchange for a grant of around ECU 42 million for near-term safety improvements and an in-depth safety assessment and an unspecified amount of loans for the rehabilitation of the country's power sector. It was thus not only surprising that the Lithuanian government agreed to the terms of the agreement. Equally interesting is the question why the NSA assumed that the Lithuanian government would actually comply with its future closure commitments: Given the non-simultaneous nature of the stipulated commitments—the NSA-sponsored upgrade work would be completed long before the Lithuanian government was expected to comply with its closure pledge—the NSA had to reckon that the incentives for the Lithuanian government to renege on its closure commitments were bound to be enormous.

The following considerations proved to be conducive to the successful conclusion of an agreement under the terms stipulated by the NSA. At the time the NSA grant agreement was finalized, the prevailing energy and economic situation in Lithuania as well as predicted electricity demand scenarios had given rise to hopes that the early closure of the Ignalina NPP could be secured without seriously affecting Lithuania's electricity supply and economic development. The ongoing economic recession following the break-up of the Soviet Union had led to a sharp reduction in industrial production in Lithuania (around 70 percent between

1991 and 1994), and consequently to an ongoing fall in domestic electricity demand (averaging around 50 percent). Energy experts had thus predicted that even without the Ignalina NPP, Lithuania would have sufficient electricity generation capacity to meet domestic power needs.[4] This prediction was supported by the results of an energy study jointly conducted by the World Bank, the IEA and the EBRD in 1992/1993 that concluded that the early retirement of both Ignalina units would be technically and economically feasible. According to demand scenarios developed by the joint study, little or no new generating capacity would be needed were the two RBMK reactors of the Ignalina NPP to be shut down anytime between 1995 and 2010. Even under a "high demand scenario" in which electricity demand would stabilize in the near-term, and then increase rapidly, capacity additions would not be required until 2002 or later.

Various other energy studies supported this conclusion by suggesting that Lithuania's potential for energy savings was at the time between 30 and 50 percent (NW, 1 December 1994: 15). It was anticipated that the rehabilitation of Lithuania's power sector—funded by loans from IFIs—would reduce the country's high reliance on nuclear power and thereby facilitate the early closure of the Ignalina NPP. To be sure, the joint study by the World Bank, the IEA and the EBRD did acknowledge a potentially serious obstacle to the early closure of the Ignalina NPP, namely the high costs of increased fossil fuel imports and lost power export revenues (IEA 1994: 130). However, energy experts argued that it was not clear at the time how future prices for fossil fuels would develop. Moreover, they pointed to the fact that by 1994 Lithuania had all but lost its traditional electricity export markets. Indeed, regional power demand had dropped sharply, Lithuania's neighbor states faced difficulties in paying for electricity imports, and the Ignalina NPP now had to compete with Russia's Smolensk NPP, which had the economic advantage of being able to purchase nuclear fuel and spare parts from the Russian nuclear industry at lower prices (NW, 1 December 1994: 15). Thus, with the bleak economic situation in the East, and with no possibilities to sell electricity to the West—grid connections to Western Europe did not yet exist—, the economic value of the Ignalina NPP as a source of export revenues was limited at the time the NSA agreement was concluded.

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[4] With a peak demand of about 2'100 MW and a total installed generation capacity of 5'820 MW, Lithuania could forego the generation capacity at Ignalina (2'500 MW) and still enjoy a surplus generating capacity even during periods of high power demand (EU Enlargement Watch 1998: 10).

A number of additional reasons explain why the Lithuanian government was willing to accept the terms of the NSA agreement. To begin with, the Lithuanian authorities were certainly interested in reducing the risk of a nuclear accident at the Ignalina NPP. And since they were dependent on Western financial and technical assistance to improve safety levels at the plant, they probably had no other choice than to accept the agreement's conditions. The Lithuanian government's desire to secure a responsible reputation and good will in the West may have further contributed to its willingness to agree to the NSA conditions. Finally, the NSA agreement had been based on rather vague and long-term conditions. The Lithuanian government had pledged to close the Ignalina NPP by the time the plant's two RBMK reactors needed rechanneling. According to the then available information, rechanneling would be required anytime between 1999 and 2002 for Ignalina unit 1 and sometime before 2010 for Ignalina unit 2. This was a rather large time frame, and future closure costs could thus be discounted at rather high rates. Furthermore, closing the two Ignalina units prior to these deadlines was dependent on the results of both the in-depth safety assessment and least-cost energy studies, and on the Western donors providing sufficient financial and technical assistance—i.e. conditions which were all subject to a high degree of uncertainty. In sum, all the considerations outlined above combined to prevent the Lithuanian government from a priori refusing to accept the rather unfavorable terms of the NSA agreement.

Having likely gained the maximum it could expect in negotiations with the Lithuanian government, the major concern on the part of the NSA was to secure Lithuania's future compliance with the terms of the agreement. The NSA's long-term closure strategy appears to have been based on the following elements. First, the NSA no doubt hoped that economic developments and the anticipated rehabilitation of Lithuania's power sector would reduce the economic case for nuclear power and thus the incentives on the part of the Lithuanian government to keep the units in operation. Second, the NSA probably assumed that the in-depth safety assessment of Ignalina unit 1 would uncover so many safety deficiencies that either the costs to further upgrade the unit could not be justified on economic grounds or the Lithuanian nuclear safety authority would have no other choice than to refuse the re-licensing of the unit on safety grounds. Finally, the NSA most likely reckoned that the Lithuanian government was particularly vulnerable to political pressure from the West. Indeed, Lithuania had for both political and economic reasons a strong interest to deepen relations with Western Europe. It was thus widely assumed that the Lithuanian government would not be willing to jeopardize this interest by uncooperative behavior in the nuclear safety field. In short, the

potentially high reputation costs of Lithuanian non-compliance with the terms of the NSA agreement tended to soothe Western concerns about the risk of a prolonged operation of the Ignalina NPP.

5.3 Implementation of the NSA Agreement

The initial implementation phase of the NSA agreement was rather successful. On the one hand, the NSA-funded safety upgrade work at the Ignalina NPP proceeded rather smoothly, with 17 of the total 20 projects completed by spring 1997, and the three remaining NSA-funded safety projects finished by 1999. On the other hand, the Lithuanian government had taken a first major step towards adhering to its closure commitments by establishing a special decommissioning fund in mid-1995 that initially received 16 percent of the profits from the sale of electricity[5]. In addition, in 1995 the Lithuanian government officially confirmed its intention to close Ignalina unit 1 by 2005 and Ignalina unit 2 before 2010 (EEE Report, October 1995: 34).

However, various developments and events in 1997 and 1998 conspired to dim the prospects of securing the early retirement of the Ignalina NPP. First, there was a considerable delay in carrying out the in-depth safety assessment of Ignalina unit 1. Originally scheduled for completion by the end of 1995, it took until late 1996 for the safety assessment to be completed and the safety analysis report (SAR) to be released.[6] This delay made it next to impossible for Vatesi to meet the mid-1998 deadline to decide on whether or not to issue a new operating license for Ignalina unit 1.[7] Throughout 1997, the Lithuanian authorities struggled with EBRD officials to extend the licensing deadline to late 1999 (NW, 10 July 1997: 4). In this effort, the Lithuanian authorities were supported by an international group of nuclear safety organizations (the so-called "Licensing Assistance Project") that argued that a sufficient amount of time was required for a proper licensing process. In early 1998 the NSA

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[5] However, in 1996 the Lithuanian authorities decided to reduce the payment rate from 16 to 4 percent. This decision drew considerable criticism from Western donor states and nuclear experts since it threatened to reduce the amount of funds available for the future decommissioning of the Ignalina NPP (Frogatt 1999; EEE Report, August 1998: 26).

[6] There had reportedly been serious difficulties in obtaining technical information from the Russian plant-designers and in tracking down relevant information at the plant (NW, 20 February 1997: 15).

[7] The safety analysis report was designed to provide a technical basis for Vatesi's decision to issue a new license for Ignalina unit 1. However, in late 1996 the report had yet to be translated into Russian, the language used by Lithuanian regulators and plant personnel for technical matters (Nuclear Energy Institute 1997: 238-239).

reluctantly compromised and agreed to extend the licensing-deadline for Ignalina unit 1 to May 1999.

Second, although the Lithuanian authorities complied with the NSA condition to draw up a loan investment program for the rehabilitation of the country's power sector (Nuclear Energy Institute 1997: 239), implementation of the power sector development program subsequently stalled, despite the apparent willingness of various IFIs to provide loans for this purpose.[8] The failure of the Lithuanian authorities to make progress in the rehabilitation of the country's power sector had much to do with the overproduction of electricity in Lithuania: Since the country was abundant in electricity, i.e. in particular in cheap nuclear power produced at the Ignalina NPP, the Lithuanian government had only little incentive to increase its debt burden by investing scarce resources in energy efficiency projects and in the rehabilitation of thermal generation capacity. However, this was a tremendous lost opportunity to significantly ease the impact of Ignalina's closure. Indeed, as the World Bank had concluded in an August 1998 report: "If only half of the estimated potential annual energy saving from conservation were realized, the country would have no need for nuclear power" (FT, 25 November 1998).

Finally, from 1997 on it had become increasingly evident that the Lithuanian government was determined to keep the two RBMK units of the Ignalina NPP in operation as long as possible. This determination was first signaled at a spring 1997 meeting between Lithuanian authorities and EBRD officials that had been convened to discuss the recommendations of the international panel. In accordance with the NSA agreement, a panel of seven international experts had assessed both the safety analysis report (SAR) and its subsequent independent review by Eastern and Western nuclear safety organizations (RSR). In March 1997, the international panel published its recommendations: Apart from being

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[8] Both the EBRD and the World Bank had proven willing to financially support alternative power generation and energy efficiency projects related to the future closure of the Ignalina NPP. In December 1992 the EBRD had approved an ECU 32 million loan to address urgent problems in energy supply and to improve energy efficiency. In addition, the EBRD considered to extend an ECU 28 million loan for the Kaunas energy sector and modernization project and examined its possible involvement in the development of private sector energy service companies (ESCOs) to support the energy efficiency improvement efforts launched under the 1992 Energy Sector Emergency Investment Loan. The World Bank approved in May 1994 a $26.4 million Power Rehabilitation Loan aimed at improving energy efficiency and the safety and reliability of the electricity system. Furthermore, in May 1996 the World Bank agreed to provide a $5.9 million loan—with an additional $6.9 million from the Global Environment Facility—for the Klaipeda Geothermal Demonstration Project. Finally, in July 1996 the World Bank approved a $10 million loan for the Lithuanian Energy Efficiency/Housing Pilot Project aimed at supporting private and public initiatives to improve energy efficiency in homes and schools. For a detailed description of these energy projects, see websites of the EBRD and the World Bank.

critical of the safety culture at the Ignalina NPP and of Vatesi's independence, the panel concluded that the continued operation of the Ignalina NPP for some years could only be justified if additional safety upgrade work in the order of $120 million was carried out immediately (Nuclear Energy Institute 1997: 238). This was a considerable amount of money for the hard-pressed country to spend on safety upgrades. Nevertheless, the Lithuanian government readily accepted the international panel's recommended safety improvements. Although it took some political pressure by the EBRD and the EU to induce the Lithuanian authorities to keep the Ignalina units down for an extended period of time in order to carry out some of the urgent safety upgrade work requested by the international panel (EEE Report, May 1997: 19-20), the Lithuanian government promptly agreed in June 1997 to implement a new safety improvement program, known as SIP-2. The Lithuanian government further announced that it would provide 80 percent of the $25 million needed for immediate safety upgrade work in 1997, while the remaining 20 percent was expected to come from a combination of EBRD loans and bilateral assistance from Sweden, the United States and Japan (EEE Report, June 1997: 2-3).

The Lithuanian government's willingness to invest a considerable amount of scarce financial resources in further safety improvements testifies to its determination to keep the two RBMK reactors of the Ignalina NPP in operation as long as possible. What accounts for the Lithuanian government's resolve in this respect? To begin with, research conducted at the Ignalina NPP in mid-1997 indicated that the life of the reactors' fuel channels could be longer than previously expected due to limited operations and extended outages at the plant. In other words, the research suggested that the scheduled closure deadlines for the two Ignalina units—i.e. as soon as rechanneling was required—could possibly be postponed. The possibility of being able to operate both Ignalina units longer than previously anticipated certainly strengthened the Lithuanian government's resolve to upgrade the Ignalina NPP for prolonged operation (EEE Report, February 1998: 34-35).

Second, Lithuania had increased its electricity exports since the time the NSA agreement had been concluded. Indeed, while total power exports amounted to only around 1 billion KWh in 1994, they had subsequently climbed up to 5.2 billion KWh in 1996.[9] Moreover, the mid-term prospects of exporting electricity to Western Europe—a commercially much more attractive option than exporting to the country's traditional markets

[9] In 1996, the Ignalina NPP sold 16 percent of its output to Belarus, 12 percent to Latvia and 4 percent to the Russian Kaliningrad region in an electricity-for-fuel swap (Nuclear Energy Institute 1997: 235).

in the East—had improved in the interim. Since mid-1995 the Lithuanian authorities had been involved in talks with Western engineering firms to construct a power line from Lithuania to Poland (Nuclear Energy Institute 1997: 235). It was then estimated that this project would effectively allow Lithuania to sell electricity worth around $100 million a year to Western Europe (EEE Report, June 1996: 8-9). The rising power exports to the country's neighbor states and the improved prospects of exporting power to Western Europe certainly enhanced the incentives on the part of the Lithuanian government to keep the Ignalina NPP in operation as long as possible. Finally, the successful implementation of the NSA-funded safety upgrade program no doubt strengthened the Lithuanian government's resolve to keep the Ignalina units running for as long as possible and hence to renege on its NSA commitment not to rechannel the two RBMK reactors. Indeed, after the externally financed safety upgrade programs had eliminated the most egregious safety shortcomings at the Ignalina NPP, the Lithuanian authorities began to argue that the premature closure of the plant could no longer be justified on safety grounds. In addition, the installation of a substantial amount of safety equipment at the plant had the effect of lowering the technical and financial barriers to the prolonged operation of the Ignalina NPP (RFE/RL Newsline, 18 March 1998, 23 October 1998; NN, May 1998: 47).

In late 1997 and early 1998, the NSA experienced a further round of setbacks in its efforts to secure the early retirement of the Ignalina NPP. First, throughout the second half of 1997 Lithuanian authorities struggled with NSA officials over the question of whether the replacement of ten defective fuel channels represented normal maintenance work or a life-extension measure (NW, 4 September 1997: 12). While initially arguing that such work violated the terms of the grant agreement, the NSA eventually gave in and accepted that the ten defective fuel channels could be replaced. Second, in an effort to determine whether further safety upgrades at the Ignalina NPP were economically justified, the EBRD had commissioned the British consulting firm ERM Energy to conduct a least-cost study of Lithuania's energy needs. This study, which was presented to the EBRD in January 1998, concluded that closing the Ignalina NPP before 2004 would not be warranted economically, and that investments to further improve safety and thus allow the plant to operate beyond 2004 could be justified on economic grounds. The study's conclusions represented a serious setback for the NSA-led attempt to secure the premature closure of the Ignalina NPP since they allowed the Lithuanian authorities to argue on economic grounds that the units' fuel

channels should be replaced to allow the Ignalina NPP to operate for another 15-20 years (NW, 29 January 1998: 6-7).

In sum, by early 1998 the widespread hopes of securing the premature closure of the Ignalina NPP in line with the NSA agreement had faded. Although the Lithuanian government was not yet obliged to deliver on its part of the NSA agreement—the licensing-deadline for Ignalina unit 1 had been postponed to May 1999, and it could not be determined with certainty when the two RBMK units required rechanneling—during the past months the Western donors had gained the impression that the Lithuanian authorities were unlikely to comply with their future commitments. This impression was reinforced not only by widespread doubts that Vatesi would be able to take an independent and objective licensing-decision for Ignalina unit 1, but also by an official statement of the Lithuanian economy minister in April 1998 that the Ignalina NPP would stay in operation as long as the plant was safe and cost-effective, i.e. not until the two RBMK units needed rechanneling as stipulated by the NSA agreement (NEI, May 1998: 4). Moreover, various Lithuanian officials had during the past months openly contemplated the idea of replacing the fuel channels of the two RBMKs to allow the Ignalina NPP to operate for another 15-20 years (NW, 29 January 1998: 6-7; NW, 9 April 1998: 7). It was at this stage of the deadlocked negotiations between the NSA/EBRD and the Lithuanian government that the European Commission intervened into the ongoing closure dispute and sought to link Lithuania's EU membership prospects to a firm commitment by the Lithuanian government to comply with the terms of the NSA agreement. Since the European Commission's attempt to secure the premature closure of the Ignalina NPP is analyzed in Case Study IV, the following assessment of the NSA's closure deal with Lithuania is limited to early 1998.

5.4 Assessment

To which extent did Lithuania change its externality-generating behavior in a direction desired by the Western donors? On the basis of the 1994 NSA grant agreement, the Western donors sought to induce and enable the Lithuanian authorities to both improve safety levels at the two inherently unsafe RBMK units of the Ignalina NPP and to prematurely close these two units. The two RBMK units of the Ignalina NPP were slated for closure at latest by the time they required rechanneling, which was then expected to occur between 1999-2002 for Ignalina unit 1, and before 2010 for Ignalina unit 2. In addition, Ignalina unit 1 would be closed by mid-1998 if the unit's continued operation could not be justified on economic

grounds and if the Lithuanian nuclear safety authority (Vatesi) could not issue a new Western-style operating-license for the unit on the basis of the results of an in-depth safety assessment. The Western donors' goal of reducing and ultimately eliminating the risk of a nuclear accident at the Ignalina NPP was only partly achieved. On the one hand, the successful implementation of the NSA-funded safety upgrade program reduced to a certain extent the risk of a nuclear accident at the Ignalina NPP. On the other hand, it was highly unlikely in early 1998 that the Lithuanian authorities would comply with those provisions of the NSA agreement that ultimately sought to secure the premature closure of the Ignalina NPP. First, it was doubtful whether Vatesi would be free enough from political pressure by the Lithuanian government to take an objective licensing-decision for Ignalina unit 1 in May 1999. Second, the Lithuanian government had indicated that it did not intend to comply with the NSA condition to close the two RBMKs once they required rechanneling and that it was considering replacing the units' fuel channels to allow the Ignalina NPP to operate for another 15-20 years. In short, the behavioral changes on the part of Lithuania encompassed a risk-reduction through the successful implementation of the NSA-funded safety upgrade program, but no risk-elimination due to the Lithuanian government's likely refusal to comply with its closure commitments.

Which cooperation strategies and what kind of measures were employed by the Western donors to influence Lithuania's behavior? The Western donors sought to secure risk-reducing and ultimately risk-eliminating behavioral changes on the part of Lithuania by a combination of the following cooperation strategies. *Normative strategies* were employed in the sense that NSA/EBRD officials and other Western nuclear safety experts had repeatedly tried to persuade the Lithuanian authorities to adopt higher nuclear safety standards and to prematurely close the Ignalina NPP on safety grounds. The employment of *cognitive strategies* was explicitly foreseen by the NSA agreement. By conducting an in-depth safety assessment of the Ignalina NPP, the Western donors sought to provide Vatesi with the necessary technical information to decide on whether the continued operation of Ignalina unit 1 beyond mid-1998 could be justified on safety grounds. Moreover, the Western donors also sought to provide the Lithuanian authorities with more reliable information on the full economic costs of operating the Ignalina NPP by commissioning least-cost studies of Lithuania's energy needs. The Western donors hoped that the results of the in-depth safety assessment and least-cost studies would induce the Lithuanian authorities to prematurely close at least Ignalina unit 1 on safety and/or economic grounds. The Western donors'

predominant cooperation strategy included the provision of *positive incentives*. Positive incentives were employed for the following measures. The NSA provided around ECU 40 million in grants for near-term technical safety upgrades at the Ignalina NPP and an in-depth safety assessment. In addition, the 1994 NSA grant agreement foresaw the provision of an unspecified amount of favorable loans by IFIs to rehabilitate Lithuania's power sector and improve energy efficiency.

To which extent was the observed behavioral change on the part of Lithuania influenced by the provision of positive incentives and how high was the effectiveness of the transaction? The observed behavioral change on the part of Lithuania was almost exclusively attributable to the provision of positive incentives. Indeed, the cognitive strategies employed by the Western donors failed or were unlikely to have any positive effect on Lithuania's behavior. First, the 1998 least-cost study on Lithuania's energy needs concluded—in contrast to earlier hopes—that further safety upgrades and the continued operation of the Ignalina NPP could be justified on economic grounds. Second, it was unlikely that the results of the in-depth safety assessment could be objectively used by Vatesi to refuse the licensing permit for Ignalina unit 1 on safety grounds. Moreover, the employment of normative strategies, while possibly raising the Lithuanian authorities' sensibility for nuclear safety matters, contributed only slightly to the final outcome. Since the provision of positive incentives resulted in improved safety levels at the Ignalina NPP, but was unlikely to secure the premature closure of the plant's two RBMK units, the *effectiveness* of the transaction was rather low.

How high was the efficiency of the transaction? *First dimension of efficiency:* The transaction was efficient in the sense that no alternative cooperation strategy could have led to comparable or superior behavioral changes on the part of Lithuania at a lower or comparable cost. The employment of positive issue-linkage strategies was unlikely to be more cost-effective than the provision of positive incentives for two reasons. First, positive issue-linkage strategies would have not provided the Lithuanian authorities with the financial and technical means to improve safety levels at the Ignalina NPP and—even more important—to prematurely close the plant's two RBMK reactors. Second, during the early 1990s there were no easily identifiable positive issue-linkages which the Western donors could have readily agreed upon and which promised to generate sufficient incentives for the Lithuanian to comply with Western closure demands. The relative cost-effectiveness of employing negative incentives suffered from similar problems. First, the employment of negative incentives was unlikely to lead to safety improvements at the Ignalina NPP. Second, it is debatable whether

economic sanctions or other threats would have enticed the Lithuanian government to comply with Western closure demands. In fact, it is not impossible that such measures would have only worsened Lithuania's economic situation and hence prompted the hard-pressed country to sustain its high reliance on the cheap power produced at the Ignalina NPP. Moreover, it is rather unlikely that the Western countries would have been willing to isolate Lithuania economically and politically at a time when the newly independent republic was struggling to break out of Moscow's orbit and anchor itself within the community of Western democratic states. Finally, and as already discussed above, the employment of cognitive or normative strategies was highly unlikely to produce a more favorable outcome from the Western donors' point of view.

Second dimension of efficiency: The transaction involved potentially serious inefficiencies because alternative ways of employing positive incentives may have possibly led to superior behavioral changes on the part of Lithuania at a comparable cost. The funding strategy pursued by the Western donors included the provision of around ECU 40 million in grants for near-term technical safety upgrades at the Ignalina NPP and an in-depth safety assessment as well as the disbursement of an unspecified amount of favorable loans by IFIs for rehabilitation and energy efficiency projects in Lithuania. This funding strategy, i.e. in particular the provision of grants for the implementation of near-term technical safety upgrades, was likely to have the unintentional effect of prolonging the somewhat improved, nevertheless still inadequate safety situation at the Ignalina NPP. Indeed, once the NSA-funded safety upgrade program had eradicated various safety shortcomings at the Ignalina NPP, the Lithuanian government had even less incentive than before to prematurely close the two RBMK units. In addition, by improving the prospects that it may be technically and financially feasible to rechannel the two RBMK units for another 15-20 years of operation, the NSA-funded safety upgrade program most likely discouraged the Lithuanian authorities from investing in projects designed to restructure the country's power sector and improve energy efficiency. As such it is rather likely that the prospects of securing the premature closure of the Ignalina NPP, and hence a satisfactory and lasting solution to the nuclear safety problem in Lithuania, would have been much better if the Western donors had refrained from funding near-term technical safety upgrades at the Ignalina NPP and employed positive incentives exclusively for measures aimed at easing the impact of the plant's closure on the country's energy and economic situation. Of course, the drawback of such an alternative funding strategy was that the Western donors would have had to accept higher levels of

nuclear risk in the short-term. However, in the mid- to long-term the Western donors would have probably secured larger and more lasting safety benefits by pursuing such an alternative funding strategy. In short, the efficiency of the transaction (second dimension) was rather low.

To which extent did the theoretically predicted problems in designing and implementing positive incentives shape the effectiveness and efficiency of the transaction? Neither *extortion*, nor *moral hazard problems* negatively affected the effectiveness and efficiency of the transaction between the Western donors and Lithuania. The Lithuanian government's behavior cannot be described as extortion in the sense that it threatened to enhance or prolong the transboundary risk posed by the continued operation of the Ignalina NPP unless it was paid for to refrain from doing so. Rather, the Lithuanian government simply gave the Western donors to understand that it did not have sufficient financial and technical resources to improve safety levels at the two RBMK units and/or to prematurely close the Ignalina NPP, and in doing so it probably did not overstate its case. Thus, the Lithuanian government did not mislead the Western donors into paying it for a behavioral change—reducing and/or eliminating the risk of a nuclear accident at the Ignalina NPP—it would have undertaken even in the absence of resource transfers. Furthermore, it is rather unlikely that the Lithuanian government engaged in moral hazard behavior in the sense that the prospect of gaining Western nuclear safety assistance induced the Lithuanian government to engage in overly risky activities and to refrain from investing its own resources to alleviate the dangerous safety situation at the Ignalina NPP. Finally, these two potential problems in designing and implementing positive incentives did not discourage the Western donors from engaging in a transaction with Lithuania.

Information and distribution problems did not negatively affect the effectiveness of the transaction. Two reasons explain why negotiations between the NSA/EBRD and the Lithuanian government on a closure deal were concluded rather quickly, i.e. without being protracted by "stingy" bargaining behavior on the part of the negotiating parties. To begin with, since the amount of grants to be gained from the NSA was limited, it made no sense for the Lithuanian government to bargain for extensive compensation. Moreover, the negotiating parties had agreed to base the NSA closure agreement on rather vague and long-term conditions, thereby allowing the Lithuanian government to discount future closure costs and granting it sufficient room for maneuver in complying with future commitments.

Enforcement problems certainly hampered the effectiveness of the transaction. Indeed, once a significant part of the funds earmarked for the safety upgrade program at the Ignalina

NPP had been disbursed, the NSA could no longer threaten to freeze the further disbursement of grant money to ensure that the Lithuanian government stuck to its commitment not to rechannel the two RBMK units for prolonged operation. Moreover, the NSA did not have any influence over the long-term investment activities of the EBRD and the World Bank, both of which proved unwilling to increase Lithuania's perceived costs of non-compliance with the NSA agreement by threatening to suspend loan financing and assistance programs.

The specific *problem-definition* adopted by the Western donors did have a negative impact on the efficiency of the transaction. The selection of potentially available measures to address the nuclear safety problem in Lithuania suggests that the Western donors adhered to a rather pro-nuclear problem-definition. Indeed, although the NSA's closure deal was based on the understanding that IFIs would provide an unspecified amount of loans for the rehabilitation of Lithuania's power sector—which, as argued above, promised to be the most cost-effective way to secure a lasting solution to the nuclear safety problem in Lithuania—, the Western donors resolved to direct a significant part of their financial and technical assistance towards the implementation of near-term technical safety upgrades at the Ignalina NPP. To a certain extent, this pro-nuclear bias in the Western donors' funding strategy can be explained by the perceived need to undertake immediate action against the risk of a nuclear accident at the Ignalina NPP. On the other hand, the propensity on the part of the Western donors to define the nuclear safety problem in Lithuania in a pro-nuclear way was no doubt strongly influenced by the commercial and political interests of the Western nuclear industry and their governmental supporters. Western nuclear engineering firms had been quick to realize that the nuclear safety problem in the East did not only represent a threat to their commercial survival, but also a tremendous commercial opportunity to secure much needed business contracts. The influential Western nuclear industry thus lobbied their respective national governments into defining the nuclear safety problem in ways that served their commercial interests, i.e. as a problem that could be solved by quick, technical solutions. Various Western governments, on the other hand, proved to be susceptible to such lobbying efforts. Indeed, by granting funds for near-term technical safety upgrades, pro-nuclear Western governments had the politically convenient opportunity to subsidize their own nuclear industries and to help them gain a foothold in the potentially lucrative Eastern nuclear market. In short, due to the specific interests of the Western nuclear industry and various pro-nuclear Western governments, the Western donors adopted a problem-definition that in effect thwarted the funding and implementation of more cost-effective capacity-building measures.

The effectiveness of the transaction was seriously hampered by the *"slippery slope effect"*. The analysis has shown that both the incentives and capacities of the Lithuanian government to rechannel the two RBMK reactors of the Ignalina NPP for another 15-20 years of operation were enhanced by the successful implementation of the NSA-funded safety upgrade program. Indeed, the externally financed modernization of the Ignalina NPP did not only make the long-term operation of the plant technically more feasible and economically more profitable, but also provided the Lithuanian authorities with the much-welcome argument that there were no longer any major safety reasons to object against the rechanneling of the two RBMK units and their prolonged operation.

Coordination problems among the donors did not negatively affect the effectiveness of the transaction. In contrast to the coordination problems observed in the previous case study on the NSA's closure deal with Bulgaria, the NSA-led attempt to secure the premature closure of the Ignalina NPP was not hampered by bids from Russian or Western nuclear firms to unilaterally upgrade the two RBMK units of the Ignalina NPP for prolonged operation. In addition, the rehabilitation of Lithuania's power sector was not delayed because the IFIs lacked the flexibility and/or willingness to extend loans for this purpose, but rather because Lithuania continued to enjoy enormous surpluses of cheap electricity generated by the Ignalina NPP, and hence had practically no incentive to invest scarce resources in a more efficient use and production of power.

6 CASE STUDY III: THE EBRD'S ATTEMPT TO SECURE THE PREMATURE CLOSURE OF BOHUNICE UNITS 1-2 IN THE SLOVAK REPUBLIC

Throughout 1994 and 1995, the EBRD sought to conclude with the Slovak government a deal designed to eliminate the safety threat posed by the continued operation of two VVER-230 reactors at the Bohunice NPP (units 1-2). Specifically, the EBRD offered to provide a substantial amount of low-interest loans for the completion and upgrading of two partly built VVER-213 units at the Mochovce NPP in exchange for a firm international commitment on the part of the Slovak government to prematurely close the two unsafe VVER-230 reactors at the Bohunice NPP by the year 2000 or once the two Mochovce units were completed. However, in late 1995, after several rounds of negotiations, the Slovak government rejected the EBRD's closure deal in favor of a Czech-Russian counter-offer to complete Mochovce units 1-2 without substantial loan conditions, and by early 1998 it had become evident that Bratislava was planning to prolong the operation of the two VVER-230 units at the Bohunice NPP.

The outcomes to be explained can be summarized as follows. *Effectiveness*: Since the EBRD failed to conclude a closure deal and to extract a firm closure commitment from the Slovak government, the effectiveness of the attempted transaction was low. *Efficiency*: The attempted transaction was efficient in the sense that the employment of no other cooperation strategy could have secured a comparable or superior behavioral change on the part of the Slovak Republic at a lower or comparable cost. However, it is not impossible that an alternative way of employing positive incentives could have led to a more favorable result. Hence, the efficiency of the attempted transaction (second dimension) was rather low. These outcomes were shaped by the following problems. The effectiveness of the attempted transaction was seriously hampered by coordination problems among the potential donors and to a certain extent also by information and distribution problems. The efficiency of the attempted transaction (second dimension) was negatively affected by the specific problem-definition adhered to by the Western donors.

The case study on the EBRD's ultimately unsuccessful attempt to secure the premature closure of Bohunice units 1-2 is structured along the following lines. The first section provides a brief introduction to the energy situation in the Slovak Republic. The second section elaborates on the genesis of the deal proposed by the EBRD to secure the premature closure of the two VVER-230 units at the Bohunice NPP. The third section examines the

developments that led to the collapse of the EBRD's closure deal. The results of the case study are summarized in the fourth and final section.

6.1 The Energy Situation in the Slovak Republic

At the time it seceded from Czechoslovakia (CSFR) and became a sovereign state on 1 January 1993, the Slovak Republic possessed a total installed electricity generation capacity of around 6'500 MW. Nearly half of this total generation capacity was installed at the country's numerous thermal power plants, roughly one quarter at various hydroelectric facilities, and around one quarter at the four-block Bohunice NPP. Bohunice units 1-2—collectively known as Bohunice V1—are both VVER-440/230 reactors, while the two newer units 3 and 4 of the Bohunice NPP are VVER-440/213s.

TABLE 6.1: OPERATING NUCLEAR REACTORS IN THE SLOVAK REPUBLIC

Power Unit	Reactor Type	Capacity (Net, MW)	Commercial Start
Bohunice 1	VVER-440/230	408	1979
Bohunice 2	VVER-440/230	408	1981
Bohunice 3	VVER-440/213	408	1985
Bohunice 4	VVER-440/213	408	1986

Source: Kurtz 1996: 139.

Besides the four-block Bohunice NPP, the Slovak Republic also had four Soviet-designed nuclear reactors at various stages of completion at the Mochovce NPP. The decision to build these four VVER-213s at the Mochovce NPP had been taken in the late 1970s under Czechoslovakia's ambitious nuclear power expansion program. Construction of the Mochovce NPP had begun in the mid 1980s, but was halted in early 1991 due to a lack of funding (Wedmore 1995: 47).

TABLE 6.2: UNCOMPLETED NUCLEAR REACTORS IN THE SLOVAK REPUBLIC

Power Unit	Reactor Type	Capacity (Net, MW)	Completion Status, in percent (as of 1995)
Mochovce 1	VVER-440/213	388	85
Mochovce 2	VVER-440/213	388	65
Mochovce 3	VVER-440/213	388	45
Mochovce 4	VVER-440/213	388	20

Source: Kurtz 1996: 139.

Although the Bohunice NPP accounted for only around one quarter of the Slovak Republic's total installed generation capacity, by 1993 over half of the country's total annual electricity output was generated by the four nuclear reactors of this plant. The Slovak Republic's enhanced relative reliance on nuclear power was a result of the Slovak authorities' decision to respond to the overall drop in electricity demand during the early 1990s by reducing electricity production at the country's hydroelectric and thermal power plants. This decision, in turn, had been prompted by the deplorable state of the country's conventional power plants, rising prices for fossil fuel imports and a desire to alleviate the country's severe environmental problems by idling thermal power plants burning low quality coal (IEA 1994: 227).

TABLE 6.3: SLOVAK ELECTRIC POWER BY SOURCE (1992)

Source	**Percent of Total Electricity Production**
Nuclear	53
Thermal	38
Hydroelectric	9

Source: IEA 1994: 229.

The increased relative attractiveness of nuclear power, coupled with predictions by Slovak energy experts that the country desperately needed additional electricity generation capacity by the end of the 1990s, had a distinctive impact on the evolving energy policies of the newly independent Slovak Republic. On the one hand, Bratislava began to consider the possibility of further upgrading Bohunice units 1-2 (Bohunice V1) for continued operation until the end of their design lives, i.e. until around 2010. Due to the inherent safety deficiencies of the VVER-230 design, the two oldest units of the Bohunice NPP had previously undergone a "small reconstruction" involving 89 separate upgrade projects at a total cost of around $67 million. However, the then Czechoslovak Atomic Energy Commission had licensed these units to operate only until 1995 (NW, 11 November 1993: 1). The Slovak government's plan to further upgrade these two units received indirect support by the IAEA which—impressed by the recently realized safety improvements—agreed with the Slovak nuclear safety authorities in mid-1993 that the implementation of an additional modernization program in the order of $200 million would justify the continued operation of Bohunice V1. The IAEA's optimistic conclusions regarding the continued operation of Bohunice V1 came somewhat as a surprise since Western nuclear safety experts had so far argued that VVER-230s could not be

upgraded to reach international safety standards—at least not at reasonable cost—and therefore should be shut down in the near-term. The IAEA's conclusions were also deeply disturbing to those Western governments and organizations which wanted to see these two unsafe nuclear reactors shut down as soon as possible.

On the other hand, the Slovak government began to show a growing interest in completing the partly built Mochovce NPP. Although the restrained financial resources of both the Slovak state and its national power company, Slovensky Elektrarne Podnik (SEP), ruled out the near-term resumption of the costly construction work, the fate of the Mochovce NPP was far from sealed. Western nuclear firms and suppliers, struggling with stagnant nuclear markets at home and therefore desperate to gain a foothold in the potentially lucrative Eastern nuclear market, had been quick to indicate their interest in re-launching the nuclear completion project. Already in late 1991, Electricité de France (EdF) had concluded with SEP a tentative agreement on the completion and upgrading to Western safety standards of Mochovce units 1-2, and in the following year EdF had conducted an extensive audit of the existing plant infrastructure and equipment (ATW, August/September 1992: 437).

From the viewpoint of those Western parties interested in completing and upgrading these two VVER-213 units, the Mochovce completion project did not only promise lucrative completion and upgrade contracts, but also held out the prospect of eliminating the safety threat posed by the continued operation of Bohunice V1. Such optimism was not unfounded. Indeed, the Slovak government had so far rejected Western demands to prematurely close Bohunice V1 on the grounds that the continued operation of these two VVER-230 units was required to meet domestic power needs. Western project sponsors thus reckoned that the completion of the two more modern VVER-213 units at the Mochovce NPP would provide sufficient power replacement capacity to enable the Slovak authorities to prematurely close Bohunice V1. Securing a source of finance, however, was key to the prospective realization of the nuclear completion project, and the interested parties hoped that the EBRD would provide the loans needed for the multi-million project.

6.2 The Genesis of the EBRD's Closure Deal

After having been tentatively approached for funding in 1992, the EBRD began in early 1993 to consider financing the completion and upgrading of Mochovce units 1-2 and subsequently entered loan negotiations with the government of the now independent Slovak Republic. From the outset of loan negotiations, the EBRD was aware that the Western-led completion of

the Mochovce NPP would be a historic and momentous project: Not only would it be the first nuclear power project to be ever funded by an IFI, but it would also represent the first project wherein Western nuclear technology and money would be used to complete and upgrade a partly built Soviet-designed NPP. Hence, an approval of loans for the Mochovce completion project was likely to set a precedent both for international funding of nuclear power projects in general, and in CEE and FSU countries in particular, where a number of similar NPPs awaited completion (NW, 8 December 1994: 4; NZZ, 7 February 1995).

Given the significance of the Mochovce completion project, the EBRD had to reckon that its prospective involvement in the project would trigger strong resistance by the governments and publics of those Western countries committed to non-nuclear energy policies. Fierce opposition to the Mochovce completion project was expected in particular from Austria which primarily due to its geographical proximity to Soviet-designed reactors in the Slovak and Czech Republics, but also in conformity with its long-term goal of establishing a NPP-free zone in CEE, had since 1990 been pressing for a premature retirement of NPPs in its two Eastern European neighbor republics (NW, 11 November 1993: 11).[1] Moreover, the anticipated opposition from Austria and other non-nuclear Western countries was likely to be reinforced by protest activities on the part of various Western environmental interest groups that opposed the construction of new NPPs in CEE and FSU countries on the grounds that they did not represent sustainable development and only served to stifle alternative energy investments. Western environmental pressure groups argued that the near-term closure of all unsafe Soviet-designed NPPs in CEE and the FSU could be secured by helping the respective countries to exploit the enormous energy-efficiency potential of their highly wasteful economies and to adopt alternative ways of meeting their energy needs (FAZ, 7 November 1994).

In anticipation of the likely difficulties in garnering sufficient international support for the Mochovce completion project, but also in conformity with its commitment to help improve nuclear safety in the region, the EBRD was determined to insist on loan conditions that promised to significantly reduce the risk of a nuclear accident in the Slovak Republic. Hence, in late 1993 the EBRD announced that its main condition for extending low-interest loans for the completion and upgrading of Mochovce units 1-2 was a firm commitment on the

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[1] For example, in 1991 the Austrian government had unsuccessfully sought to induce the Czechoslovak government to close the Bohunice NPP by holding out the prospect of free electricity supplies (NW, 7 February 1991: 12).

part of the Slovak government to prematurely close—preferably by 1995—Bohunice V1, whose two VVER-230 units were considered to pose a serious nuclear safety threat to both Western and Eastern Europe. The EBRD stipulated its main loan condition for the Mochovce completion project at a critical time since Bratislava had been working on a plan to further upgrade Bohunice V1 for continued operation until around 2010. Although the EBRD's strategy of linking loan financing for the Mochovce completion project to the premature closure of Bohunice V1 effectively aimed to induce the Slovak government to cancel the extensive modernization program at Bohunice V1, Bratislava still faced strong incentives to consider the option of upgrading the two VVER-230s for prolonged operation. To begin with, Slovak energy planners had deemed the two VVER-230 units of the Bohunice NPP, which together provided around 25 percent of the country's electricity supply at comparatively low cost, essential to meet the country's power needs. Moreover, a continued operation of Bohunice V1 would allow the Slovak authorities to accumulate the necessary funds for the eventual decommissioning of the two units. Finally, domestic doubts about the risks and the technical feasibility of upgrading Bohunice V1 for long-term operation had waned as a consequence of the generally good safety grades attested to the plant in mid-1993 by the IAEA. Under such circumstances, Bratislava was far from keen to close Bohunice V1 in the near future, at least not until additional power generating capacity had been brought on line, and therefore sought to separate the two issues in loan negotiations with the EBRD (NW, 11 November 1993: 11).

While negotiations between the EBRD and the Slovak government on the terms of the Mochovce loan stalled throughout late 1993 and early 1994, project preparations initiated by interested firms and utilities proceeded rather smoothly and reached a first breakthrough in January 1994 as EdF and SEP established the joint venture Elektrarne Mochovce (EMO). EMO, owned 51 percent by EdF and 49 percent by SEP, would operate the Mochovce NPP and export part of the electricity produced at the plant's two completed units to Western Europe to help pay back the loans. Since EdF and other interested Western partners such as the German utilities Bayernwerk and Preussenelektra had previously made their involvement in the proposed Mochovce completion project dependent upon the earliest possible closure of Bohunice V1, the formation of EMO indicated that SEP had accepted an explicit link between international loan financing to complete Mochovce units 1-2 and the premature closure of Bohunice V1 (NW, 27 January 1994: 11).

Despite these tentative steps towards an agreement, the Slovak government under Prime Minister Meciar continued to adhere to an ambivalent position vis-à-vis the EBRD's main condition for loan financing. On the one hand, in early May 1994 Bratislava allotted $190 million for an extensive modernization project at Bohunice V1 and subsequently awarded the German firm Siemens the basic engineering contract for most of the proposed upgrade work (FAZ, 25 October 1994; NEI, October 1994: 54-56). This decision by the Slovak government provoked fierce outrage at the EBRD since it threatened to undermine the bank's efforts to link funding for the Mochovce NPP to the premature closure of Bohunice V1. Indeed, if the Slovak government was to invest so much money in the modernization of Bohunice V1, it would certainly have even less reason to close these two units in the near future. On the other hand, the Slovak government surprised Western governments by issuing a resolution on 14 May 1994 which committed the Slovak Republic to close Bohunice V1 by the year 2000, or as soon as the two new Mochovce units were completed. This move left Western governments wondering whether or not the Slovak government's unilateral closure resolution was simply a bargaining tactic to soothe Western suspicions of Bratislava's intentions and thereby pave the way for international financing of the Mochovce completion project.

Notwithstanding widespread doubts about the sincerity of the Slovak government's May 1994 closure resolution, this unilateral commitment apparently convinced various Western governments and financial institutions that a closure deal along the lines proposed by the EBRD was within reach. By mid-1994 both the European Commission and the French and German governments had officially announced their intention to support the EBRD in financing the nuclear completion project. The EBRD, on the other hand, proceeded with its project preparations by assessing whether the completion and upgrading of Mochovce units 1-2 could be justified on safety, environmental and economic grounds. After a nuclear safety review and an environmental assessment had given green light to the project, a least-cost study prepared by the consulting firm Putnam, Hayes & Bartlett concluded in late 1994 that completing Mochovce units 1-2 would be the most economic option to meet Slovak energy needs, even assuming an enhanced energy-efficiency rate of Slovak industry (NW, 8 December 1994: 3-5). On the basis of varying assumptions concerning the Slovak Republic's economic development, fossil fuel prices, and discount rates, the least-cost analysis argued that completing Mochovce units 1-2, estimated to cost DM 1.452 billion (then about $945

million), would save between DM 87 million and DM 739 million compared to alternative energy projects.

After the proposed nuclear completion project had taken these hurdles, the EBRD published the official Mochovce financing plan in mid-December 1994. According to the plan, the EBRD would provide the largest single financial contribution to the estimated DM 1.452 billion completion project, i.e. DM 412.5 million (then about $270 million), or roughly 28 percent of the total project costs. The second major source of finance was the EU, which agreed to contribute DM 366.3 million in Euratom loans, i.e. around 25 percent of the total project costs. The remaining funds were expected to come from French and German government export credits (around 20 percent) and from the three Western European firms and utilities expected to be heavily involved in the project, i.e. besides EdF as prime contractor and co-owner of the Mochovce NPP, also Bayernwerk and Preussenelektra which were interested in importing electricity from the completed plant. However, since both the European Commission and the French and German governments had stated their intention to proceed with project financing only if the EBRD took the lead, the whole project hinged upon a loan approval by the EBRD, a decision that was then scheduled for March 1995.

The EBRD insisted on five conditions for financing the completion and upgrading of Mochovce units 1-2. First, it insisted that Bratislava firmly commit itself to the closure of Bohunice V1 by the year 2000 or once the two Mochovce units were completed. The EBRD had originally wanted to see the two unsafe reactors at the Bohunice NPP shut down in 1995. However, the bank was effectively forced to compromise on the closure deadline because Bratislava was determined to upgrade the two units for continued operation beyond 1995. Nevertheless, the EBRD's main loan condition still promised to secure considerable safety benefits because the implementation of the extensive modernization program at Bohunice V1 held out the alarming prospect of these two units being operated until 2010. Second, the EBRD insisted that the Slovak government increase electricity prices sharply—between 20 and 30 percent—to ensure that the loan recipient would be able to repay the loans. Third, the bank demanded that the Slovak Republic adhere to the Vienna Convention to shield Western nuclear suppliers from potential liability claims (Wedmore 1995: 46). Finally, two additional conditions stipulated by the EBRD, i.e. that the two Soviet-designed reactors of the Mochovce NPP must be completed and upgraded to Western safety standards and that the project must constitute the least-cost investment option for the Slovak Republic's energy needs, had allegedly been met by the conclusions of the then recently submitted nuclear safety review

and the results of the least-cost study conducted by Putnam, Hayes & Bartlett. In light of the great significance of the nuclear completion project, the EBRD decided to launch a public participation process to avoid any charges of lack of consultation (EEE Report, January 1995: 25). The EBRD even agreed to go beyond normal bank procedures by releasing the full least-cost study of the project, a decision that reflected the bank management's willingness to meet non-governmental environmental organizations at least halfway in the Mochovce project assessment process.

6.3 The Collapse of the EBRD's Closure Deal

In early 1995 the controversy surrounding the Mochovce completion project came to a head as the Austrian government, supported by other non-nuclear Western European countries and various environmental groups, energetically contested the project in an attempt to both prevent the EBRD from approving the Mochovce loans and to persuade the bank to consider alternative investment options.[2] Project opponents focused their criticism on the EBRD's least-cost study (NW, 19 January 1995: 12-15). Specifically, the study was criticized for having based its final conclusions on assumptions that were clearly biased in favor of completing Mochovce units 1-2, i.e. on increasing fossil fuel prices (around 60 percent over the following four years) and low discount rates for the capital invested in the Mochovce NPP. Moreover, critics pointed out that even in the most favorable scenario assumed by the least-cost study, completing Mochovce units 1-2 had been found to be only 5 percent cheaper than the construction of a new combined-cycle gas turbine plant, and that with only slight modifications to the assumptions, construction of a gas-fired power plant would turn out to be the most economic option.[3]

The fact that the alternative investment option of constructing a gas-fired power plant had been defeated by a small margin gave rise to widespread suspicions that the EBRD had manipulated the input of the least-cost study to ensure that the nuclear completion project passed the assessment process as the least-cost investment option. Project opponents saw such suspicions corroborated by the following circumstances. First, Austrian officials had claimed

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[2] The controversy surrounding the Mochovce completion project was highlighted by following protest activities during the public consultation process: A petition signed by 1.3 million people opposing the project, 200 technical critiques, and 105 pressure groups from 14 countries registering their opposition (Frogatt 1999).

[3] For an in-depth critique of the least-cost study on the Mochovce completion project, see Energy Economist, January 1995: 5-12.

in early 1995 that between the first and second stage of the least-cost analysis, the consultants of Putnam, Hayes & Bartlett had lowered the discount rate used in their cost calculations from 12 percent to 10 percent, thus favoring the nuclear option (NW, 19 January 1995: 15). Second, project opponents could point to a recent precedent in which the completion of VVER-213 reactors had not been considered to be an economic course of action: After Germany had inherited VVER-213 reactors at the Greifswald NPP from the former German Democratic Republic in 1990, the German authorities faced a similar decision as the EBRD was now confronted with in the Slovak Republic. Although the German authorities had considered the task of completing the reactors to Western safety standards to be technically possible, they decided to decommission the Greifswald NPP because the costs to complete and upgrade the VVER-213 units could not be justified on economic grounds (Wedmore 1995: 48).

The third, and probably most important circumstance which served to deepen suspicions that the EBRD was bent on squeezing the nuclear completion project through the assessment process was the fact that EBRD's management—led by the bank's then French President de Larosière—had staffed the Mochovce project team exclusively with French nationals. Such a move was not insignificant when taking into account that the French state-owned utility EdF stood to benefit considerably from the realization of the Mochovce completion project, especially with a view to the competitive advantage the utility was expected to thereby gain over other Western nuclear firms in the potentially lucrative Eastern nuclear market.[4] Given the French commercial interests involved in completing the two Mochovce units, suspicions abounded that the French project team had manipulated the least-cost study to ensure that the Mochovce completion project would come through as the most economic option (FT, 12 March 1995). Not surprisingly, EBRD's management repudiated such accusations and sought to check the rising tide of protests against the project with the argument that without the provision of loans for the Mochovce completion project, the West would have no leverage to secure the early closure of Bohunice V1. This argument, however, had been losing credibility due to the continued failure of the Slovak government to convince Western governments and publics of its firm intention to close the two older Bohunice units by the year 2000 or once the Mochovce units were completed. As a matter of fact,

[4] One project opponent put it this way: "EdF wants to expand into new markets on the back of European taxpayers. If they get this project [the Mochovce completion project], they will get them all" (FT, 12 March 1995).

inconsistent statements by Slovak officials regarding the closure deadline for Bohunice V1 most likely deepened Western suspicions of Bratislava's dubious policy stance on the closure issue.[5]

The persisting controversy over and the concomitant rise in opposition to the Mochovce completion project, which was no longer limited to environmental groups, but also included EBRD managers and various member governments (Wedmore 1995: 46), triggered a process of crumbling support for the EBRD's closure deal. In early February 1995, the Austrian Parliament passed a resolution calling for the country's withdrawal from the EBRD if the bank approved loans for the Mochovce NPP (NW, 16 February 1995: 9-10). In the same week, the German utility Preussenelektra announced that it was canceling its participation in the nuclear completion project because it was not convinced of the Slovak government's resolve to shut down Bohunice V1 as envisaged in the EBRD closure deal. Bayernwerk followed suit with a statement that although it was still interested in importing cheap electricity from the Mochovce NPP, it would not officially join EMO. On 15 February, the European Parliament intensified the dispute by adopting a non-binding resolution opposing the completion of the Mochovce NPP on the grounds that the project lacked sufficient safety guarantees. The resolution called on the EBRD and the European Commission to undertake further in-depth investigations before acting on the proposed Mochovce loans (NW, 23 February 1995: 3).

While the lack of agreement in the West called into question the fate of the Western-led Mochovce completion project, a potentially even more serious threat to the EBRD's closure deal arose from the East: On 13 February Slovak and Russian Prime Ministers, Meciar and Chernomyrdin, signed a letter of intent in Bratislava in which Moscow agreed to grant the Slovak Republic a $150 million credit towards the completion of the Mochovce NPP (NW, 16 February 1995: 9). Chernomyrdin's proposed Russian-led project was substantially cheaper than the one proposed by the EBRD, not least because it did not include the safety upgrades envisaged in the Western-led nuclear completion project. The Russian counter-offer was certainly attractive to the Slovak government: Besides being considerably cheaper, it neither contained the condition to raise electricity prices nor the obligation to prematurely close Bohunice V1. Whereas the Western project sponsors portrayed the Russian counter-

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[5] Indeed, whereas a top Slovak official stated in February 1995 that Bohunice V1 would be closed a year after the Mochovce NPP was commissioned, Prime Minister Meciar announced during a visit to Vienna in early March 1995 that the Slovak Republic would shut down Bohunice V1 by 2005 (NW, 16 March 1995: 6).

offer as a serious threat both to the EBRD's closure deal and Western nuclear safety efforts in general, Austria and other Western project opponents downplayed the prospects of Russia taking over the project. They doubted that the Slovak government had the political clout to complete the two Mochovce units without upgrading them to Western safety standards since EU-newcomer Austria could threaten to block the Slovak Republic's proposed entry into the EU over such an issue (NW, 30 March 1995: 17).

Notwithstanding the potential implications of the Russian counter-offer for the EBRD's closure deal, the battle over the Western-led completion project continued to rage in the West during the run-up to the crucial financing decision by the EBRD board, then scheduled to be taken on 27 March 1995. The European Parliament intervened once again into the dispute on 15 March by stating its doubts about the safety and cost-effectiveness of the Mochovce completion project and insisting on various conditions to be met before the EBRD and the European Commission approved any loans. By this time, EBRD-internal support of the project had crumbled to the extent that a positive board decision was far from clear. While France in particular, but also Germany were strongly in favor of the project, the governments of Austria, Denmark, Luxembourg, Netherlands, Norway, Poland, Hungary and Greece had officially or unofficially stated their opposition. Moreover, the U.S. government, whose vote was considered to be key to the EBRD's decision, had so far wavered on the issue. In the end, however, the EBRD did not have to take a decision: On 22 March 1995 the Slovak government requested that the EBRD board postpone its vote on financing the Mochovce completion project (NW, 23 March 1995: 1, 12-13).

The Slovak government had officially based its postponement request on the March 15 European Parliament resolution which had set a broad list of prerequisites to be met before the EBRD and the European financing institutions acted on any loans. This official statement was widely regarded in the West as to have disguised Bratislava's deeper reasons for requesting the postponement of the financing decision. Various Western officials claimed that Bratislava had already decided to ditch the Western-led nuclear completion project in favor of new counter-offer, said to be 30 percent cheaper, to finish the plant with Skoda Prague and Russian Minatom. Other observers argued that the Slovak government was still interested in pursuing the Western-led project, but had used the postponement request as a bargaining tactic to extract more favorable terms from the EBRD. On balance, the latter interpretation appears to be more credible. Indeed, by acceding to the Vienna Convention on 7 March 1995, the Slovak government had complied with at least one important condition of the EBRD.

Moreover, Prime Minister Meciar was said to have balked not only at the total costs of the Western-led project, but also at certain conditions laid down by the Western financing institutions (NW, 30 March 1995: 17). In particular the EBRD's insistence on substantial electricity price increases had reportedly irritated the Slovak government since Bratislava was concerned that such price hikes would force many Slovak enterprises into bankruptcy and add to the country's already high unemployment rate (EEE Report, April 1995: 2-3).

After days of silence, Bratislava announced that its request to postpone the vote on financing the completion of Mochovce units 1-2 did not mean that it had ditched the Western-led project, but rather that it wanted to evaluate alternative offers, such as a recent proposal involving Czech bank financing and construction work by Skoda Prague[6], and an earlier bid from Russian industry, with corresponding credits.[7] Austria, now facing the even more dire prospect of having to live with a Slovak NPP operating at conventional Eastern European safety standards near its borders, sought to increase the costs of a possible Slovak choice in favor of one of the counter-offers. At a meeting of EU foreign ministers in Luxembourg in early April 1995, Austria's then foreign minister Alois Mock warned aspiring members of the EU in CEE that they could not expect to join the EU without adequate safety standards for their nuclear power plants (Wedmore 1995: 50). Austria's threatened issue-linkage, however, was overshadowed by the dimming prospects that funding for the Western-led nuclear completion project would be approved by IFIs: In mid-April 1995 the European Investment Bank (EIB), which had been previously asked by the European Commission to give its opinion on the provision of an Euratom loan for the nuclear completion project, issued a report stating that it was not convinced that completing Mochovce units 1-2 represented the least-cost investment option and that under certain circumstances a phased investment in a gas-fired power plant would be economically more adapted to the Slovak Republic's energy situation (NW, 20 April 1995: 4).

Apparently speculating that the EBRD would eventually soften its stance, during the subsequent months Bratislava repeatedly asked the Western parties involved in the nuclear completion project to reconsider their bids and conditions. However, apart from suggesting to

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[6] Skoda's interest in completing the project can be at least partly explained by the fact that the Czech engineering firm was hoping to retrieve some of the $30 million it had already invested in the aborted original Mochovce project (NW, 26 October 1995: 1, 11).

slightly modify the Western-led project in order to provide for a minimum input of Russian firms, the EBRD was unwilling to climb down on its original conditions (NW, 1 June 1995: 4). Moreover, with the Slovak nuclear safety authority apparently convinced that the implementation of the extensive modernization program at Bohunice V1 would allow these two VVER-230 units to operate safely until the end of their design lives, the prospects that the Slovak government would give its consent to a deal involving the early closure of Bohunice V1 looked increasingly bleak (NW, 24 August 1995: 13-14). It was therefore no great surprise that on 5 September 1995 the Slovak government formally rejected the deal proposed by the EBRD on the grounds that it involved unacceptable conditions, and announced that it would pursue an alternative offer from Skoda Prague, with financing from Czech and Slovak banks, the Russian government, and other sources. Not only was the Skoda-led project then estimated to be almost 30 percent cheaper than the Western-led project, i.e. total estimated project costs amounted to DM 1 billion instead of DM 1.452 billion, but the alternative offer also did not link project funding to substantial electricity price increases and to the premature closure of Bohunice V1.

In an effort to alleviate Western concerns about the safety of the Skoda-led project and to muffle Western disenchantment with its decision to reject the EBRD's closure deal, the Slovak government offered EdF and its partners a technical role in the new project. Although EdF had originally predicated its participation in the nuclear completion project on the conditions that the Mochovce NPP be built to Western safety standards and that the plant's completion be linked to the early closure of Bohunice V1—two conditions that were no longer met by the new completion deal—the French utility eagerly signed up to the new project. Not surprisingly, EdF was reluctant to see the money and time it had invested so far in the Western-led project wasted and to turn down potentially lucrative contracts, and thus concluded an agreement with SEP in mid-December 1995 on the provision of technical and support services in project control, quality assurance and safety improvements (EEE Report, January 1996: 4). Moreover, in April 1996 SEP concluded a contract worth about $100 million with Eucom, a European consortium consisting of Framatome and Siemens, to upgrade the two Mochovce units to levels consistent with IAEA safety recommendations. Following various modifications to the original project proposed by Skoda, the total costs of

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[7] In early April 1995, SEP director Kvetan confirmed that there was still a chance that the EBRD would finance the Mochovce completion project, but added that he hoped EdF would cut the project costs and that the EBRD would renounce its condition that Bratislava raise electricity prices by almost 30 percent, and instead accept the 10 percent suggested by the Slovak government (NW, 4 May 1995: 12).

the new Mochovce completion project were estimated to amount to DM 1.3 billion, i.e. a saving of around 10 percent on the initial scheme proposed by the EBRD. The bulk of the money required for the completion work was scheduled to come from both Czech and Slovak banks and from the Russian government. Financing for the safety upgrade work performed by Eucom was slated to come from France's Société Générale and Germany's Kreditanstalt für Wiederaufbau (NW, 23 May 1996: 8).

Since the deal proposed by the EBRD failed to materialize, the Slovak government had no contractual obligation to prematurely close Bohunice V1. Hence, Western hopes to eventually eliminate the safety threat posed by the continued operation of these two VVER-230 units clung to the Slovak government's May 1994 unilateral commitment close Bohunice V1 by the year 2000 or once the two new Mochovce units were operational. However, during the subsequent years these hopes gradually faded. Indeed, although the Skoda-led Mochovce completion project had reached its final stages by early 1998—unit 1 was then scheduled to start in mid-1998, and unit 2 was expected to be completed in 1999—, the Slovak government had so far failed to credibly signal that it would honor its May 1994 closure commitment. Even more alarming, in late 1997 Slovak energy authorities had indicated that an early closure of Bohunice V1 might not be possible due to rising domestic electricity demand. Finally, the implementation of the expensive modernization program at Bohunice V1—unit 1 was slated to be completed in 1999 and unit 2 in the first half of 2000—had exacerbated Western concerns that the Slovak government was planning to keep these two units on line well into the next century in order to recoup the considerable investment. Prompted by the growing risk that the Slovak government would refuse to honor its unilateral closure commitment, the European Commission stepped up the pressure on Bratislava in late 1998 by linking the country's EU membership prospects to the establishment of a "realistic" closure schedule for the two VVER-230 units at the Bohunice NPP. These efforts by the European Commission to secure the premature closure of Bohunice units 1-2 are analyzed in Case Study IV. The following assessment is thus restricted to the EBRD's ultimately unsuccessful attempt to condition the provision of low-interest loans for the Mochovce completion project on a firm commitment by the Slovak government to prematurely close Bohunice V1.

6.4 Assessment

To which extent did the Slovak Republic change its externality-generating behavior in a direction desired by the Western donors? By offering favorable loans for the completion and upgrading to Western safety standards of Mochovce units 1-2, the EBRD had sought to induce and enable the Slovak government to prematurely close Bohunice V1 by 2000 or once Mochovce units 1-2 were operational. The Western donors' goal of eliminating the safety risk posed by the continued operation of Bohunice V1 was not achieved: Due to the collapse of the EBRD's closure deal in late 1995, Bratislava had no contractual obligation to prematurely close Bohunice V1. In addition, by early 1998 it had become evident that the Slovak government—in defiance of its May 1994 unilateral commitment to close Bohunice V1 by the year 2000 or once Mochovce units 1-2 went on line—was planning to keep these two unsafe units in operation for years to come. In short, by rejecting the EBRD's closure deal and subsequently making preparations for the long-term operation of Bohunice V1, the Slovak Republic failed to alter its behavior in a direction desired by the Western donors.

Which cooperation strategies and what kind of measures were employed by the Western donors to influence the Slovak Republic's behavior? While the Western donors adhered in part to *normative strategies*—Western nuclear safety officials had repeatedly sought to convince the Slovak government of the necessity to close Bohunice V1 on safety grounds—, the dominant cooperation strategy employed by Western donors consisted of a deal involving the provision of *positive incentives*. It is certainly true that the nature of the EBRD's closure deal was to a certain extent commercial in the sense that the Slovak Republic would have had to pay back, with interest, the loans extended by the IFIs to complete Mochovce units 1-2. Nevertheless, the EBRD's closure deal did comprise a positive incentive strategy by virtue of the fact that it involved the attractive offer by IFIs to provide a considerable amount of low-interest loans under long-term repayment conditions. With a view to the fact that the Slovak government lacked the financial resources to complete units 1-2 of the Mochovce NPP without external financing, and taking into account the financial risk the IFIs were willing to shoulder with their prospective involvement in the multi-million nuclear completion project, this offer did indeed constitute a positive incentive.

To which extent was the observed behavioral change on the part of the Slovak Republic influenced by the provision of positive incentives and how high was the effectiveness of the attempted transaction? Since the Slovak government rejected the EBRD's

closure deal in favor of an unconditional Czech-Russian counter-offer and was hence unlikely to prematurely close Bohunice V1 in the near future, the *effectiveness* of the attempted transaction was low. In other words, the attempted transaction was ineffective in driving the Slovak Republic's behavior in a direction desired by the Western donors.

How high was the efficiency of the attempted transaction? *First dimension of efficiency*: The attempted transaction was efficient in the sense that the employment of no alternative cooperation strategy would have likely led to comparable or superior behavioral changes on the part of the Slovak Republic at a lower or comparable cost. This assessment is based on the following considerations. In contrast to the Bulgarian and Lithuanian cases, there was less need for the Western donors to provide the Slovak Republic with the financial and technical means to reduce the near-term risk of a nuclear accident at Bohunice V1. Indeed, the Slovak Republic disposed over the financial and technical resources to implement safety upgrades at the two VVER-230 units of the Bohunice NPP, and was apparently determined to do so. To achieve their nuclear safety goals, the Western donors had to induce the Slovak government to prematurely close Bohunice V1. However, Bratislava was unwilling to comply with Western closure demands primarily because it was concerned that the Slovak Republic could not afford to forgo the power supplied by Bohunice V1, at least not until additional power generation capacity had been brought on line.

Against this backdrop, it becomes clear why alternative cooperation strategies were unlikely to be more cost-effective than positive incentives. While the employment of positive issue-linkage and negative incentive strategies would have arguably raised the stakes for the Slovak government to comply with Western closure demands, it is unlikely that these strategies would have been effective due to their incapacity to address the underlying cooperation problem, i.e. the Slovak government's concern that the country lacked the power generation capacity to do without Bohunice V1. Indeed, it is difficult to see how some positive issue-linkage or, conversely, the imposition of economic sanctions, would have enabled the Slovak authorities to construct additional electricity generating capacity needed to replace the power of Bohunice V1. Moreover, it was unlikely that the Western donors would have been able to identify and agree upon a positive issue-linkage of sufficient value to the Slovak Republic. One possible issue-linkage, i.e. making the Slovak Republic's prospects of joining the EU conditional on the premature closure of Bohunice V1, was at the time no option for the majority of EU Member States, with the notable exception of EU-newcomer Austria. Moreover, such an issue-linkage would have probably been ineffective in the near-

term due to the fact that decision-makers in Bratislava were aware that it would take considerable time before the Slovak Republic's membership bid would be seriously considered by the EU. It was also unlikely that Western donors would have been willing to bear the potential costs of employing a negative incentive strategy, which involved the risk of exacerbating the country's transformation problems and hence provoking political instability both in the Slovak Republic and the region. Finally, the employment of normative or cognitive strategies was also highly unlikely to be more cost-effective than the provision of positive incentives. The Western donors in fact employed normative strategies, but to no apparent avail. The potential cost-effectiveness of cognitive strategies was also low. Indeed, under the given circumstances it is difficult to see how the provision of more complete information on the full costs and risks of keeping Bohunice units 1-2 in operation would have induced the Slovak government to comply with Western closure demands.

Second dimension of efficiency: The attempted transaction may have involved serious inefficiencies because the possibility cannot be ruled out that an alternative way of employing positive incentives might have led to comparable or superior behavioral changes on the part of the Slovak Republic at a lower or comparable cost. Indeed, instead of proposing to fund the completion of Mochovce units 1-2, the EBRD could have offered to provide favorable loans for the potentially less expensive option of constructing a new gas-fired power plant in exchange for the premature closure of Bohunice V1. Non-nuclear Western countries such as Austria, but also various environmental interest groups had from the beginning of the anticipated closure deal lobbied the EBRD to pursue this alternative investment option on the grounds that the construction of a new gas-fired power plant would be both more economical and environmentally safe than the proposed nuclear completion project. In late 1994, the consulting firm Putnam, Hayes & Bartlett, which had been commissioned by the EBRD to assess the cost-effectiveness of various energy investment options for the Slovak Republic, had concluded that this alternative investment option was more expensive than the completion of Mochovce units 1-2. However, a closer examination of the consulting firm's least-cost study in early 1995 revealed that the study's baseline assumptions were strongly biased in favor of the nuclear option and that with only slight modifications to the assumed discount rates and projected fossil fuel prices, the construction of a gas-fired power plant would have constituted the least-cost investment option.

While it is plausible to suggest that the option of funding the construction of a gas-fired power plant would have been less expensive, evaluating whether this alternative way of

employing positive incentives would have been more effective is highly speculative. On the one hand, it is necessary to explore whether the Slovak government would have accepted a deal involving the funding of a gas-fired power plant in exchange for the early closure of Bohunice V1. The answer to this issue basically depends on two circumstances. First, it depends on the degree to which the Slovak government was determined to complete the Mochovce NPP. If the Slovak authorities were bent on completing the Mochovce NPP, then the alternative option would have likely been rejected. Conversely, if the Slovak leadership accepted that the planned additional power generation capacity could be non-nuclear, then the alternative option would have had good chances of being considered. With a view to the fact that Prime Minister Meciar had still been considering non-nuclear alternatives as late as mid-1995 (NW, 13 July 1995: 1), the latter interpretation appears to be more credible. Second, it depends further on the precise reasons why the Slovak government turned down the Western-led Mochovce completion project in favor of the Czech-Russian counter-offer. If the Slovak government's main reasons were the relatively high costs of the Western-led nuclear completion project and the related condition to sharply increase electricity prices in order to secure the future repayment of the disbursed loans, then it would have probably accepted the potentially cheaper option of constructing a gas-fired power plant. However, if the main reason for the Slovak government's rejection of the Western-led nuclear completion project was the EBRD's condition to prematurely close Bohunice V1, then the alternative option to fund the construction of a gas-fired power plant—also linked to an early retirement of Bohunice V1—would have probably been rejected as well. Since little is known about the precise cost-benefit calculations the Slovak government made while considering the EBRD's closure deal, any conclusions regarding the issue of whether the Slovak Republic would have accepted a closure deal involving the construction of a gas-fired power plant must remain tentative.

On the other hand, we need to consider the possibility that the Western donors might have been in a more favorable position to entice the Slovak government to accept a closure deal if the alternative investment option had been pursued from the beginning. This hypothesis is based on the observation that the Western-led nuclear completion project was highly controversial in the West, not only due to the implications of the project for the future of nuclear power in the region, but also due to widespread allegations that the EBRD had manipulated its least-cost study to ensure that the nuclear completion project passed the assessment process. The controversy surrounding the EBRD's closure deal, in turn, led to a

widening fissure among the Western donors. Against the backdrop of crumbling Western support for the Western-led completion project, the EBRD and other Western project proponents were in a weakened position to forcefully press the Slovak government to accept the proposed closure deal, especially after the Czech and Russian nuclear industry had made counter-offers. It is no doubt speculative whether in the absence of such controversy a united Western donor front could have deterred the Slovak government from rejecting a deal involving the premature closure of Bohunice V1. Nevertheless, it is plausible to suggest that the alternative option of constructing a gas-fired power plant would have been far less controversial than the Mochovce completion project, and would have hence provided the Western donors with a relatively stronger bargaining position.

Finally, it is necessary to take into account the possibility that the controversy surrounding the Western-led nuclear completion project may have prompted the Slovak government to consider counter-offers to complete the Mochovce NPP in the first place. The Slovak government's position on the Mochovce completion issue was strongly determined by its national energy plan, according to which a predicted rise in domestic energy demand would necessitate the introduction of additional power generation capacity by the end of the 1990s. A timely completion of new power units—either nuclear or thermal—was therefore a high priority for Bratislava. The strong controversy surrounding the Mochovce completion project in the West had exacerbated fears on the part of Slovak decision-makers that the Western-led nuclear completion project might be delayed, or even worse, might fail to be approved by the EBRD board. Indeed, in spring 1995 both the European Parliament and the EIB had called upon the EBRD to reassess the project's safety and cost-effectiveness, and internal EBRD support of the project had by this time crumbled to the extent that a positive board decision was far from certain. Faced with such uncertainty about the Western-led completion project, the Slovak government may have begun to seriously consider counter-offers from Czech and Russian industry. It is hence possible that a Western offer to fund the construction of a less controversial, gas-fired power plant would have not driven the Slovak government to consider counter-offers. In sum, while the provision of positive incentives was probably the most cost-effective cooperation strategy to secure the premature closure of Bohunice V1, it is not impossible that an alternative way of employing positive incentives—i.e. funding the construction of a gas-fired power plant instead of the completion of Mochovce units 1-2—might have been more cost-effective. Hence, the efficiency of the attempted transaction (second dimension) was rather low.

To which extent did the theoretically predicted problems in designing and implementing positive incentives shape the effectiveness and efficiency of the attempted transaction? The outcomes to be explained were unaffected by *extortion and moral hazard problems.* The Slovak government did not engage in extortion, i.e. it did not threaten to increase or prolong the safety threat posed by the continued operation of Bohunice V1 unless the Western donors paid it to refrain from doing so. Instead, Bratislava had signaled its willingness to consider prematurely closing Bohunice V1 provided that external financing for the construction of power replacement capacity was forthcoming. As such the Slovak government did not attempt to extract a payment from the Western donors for a behavioral change—prematurely closing Bohunice V1—it would have undertaken even in the absence of such a payment. Nor does the analysis suggest that the Slovak government engaged in moral hazard behavior. Indeed, the prospect of gaining loan financing for the Mochovce completion project did not induce the Slovak authorities to accept higher levels of nuclear risk at Bohunice V1 or reduce their willingness to unilaterally improve the safety situation at the plant. Moreover, these two potential problems in designing and implementing positive incentives did not deter the Western donors from seeking to engage in a transaction with the Slovak Republic.

Information and distribution problems negatively affected the effectiveness of the attempted transaction. On the one hand, uncertainties regarding the long-term development of fossil fuel prices and the Slovak Republic's future energy demand intensified the dispute over whether the completion of Mochovce units 1-2 represented the least-cost investment option for the country's power needs. On the other hand, incomplete information regarding Bratislava's "real" intentions to comply with its commitment to close Bohunice V1 by 2000 or once Mochovce units 1-2 were completed hampered the timely conclusion of a closure deal. Indeed, widespread doubts in the West about the Slovak government's sincerity to shut down Bohunice V1 in the near future provoked rising opposition to the closure deal by various EBRD member countries and prompted Preussenelektra and later Bayernwerk to withdraw from the Western-led nuclear completion project. Distribution problems, which led to protracted negotiations on the conclusion of a deal, arose from the Slovak government's repeated efforts to ease the conditions the EBRD had been seeking to impose on its loan financing program for the Mochovce completion project. Indeed, the Slovak government most likely used its March 1995 request to postpone the EBRD's vote on the loans as a bargaining tactic to extract more favorable terms from the bank, in particular with respect to the project

costs and the related condition to sharply increase electricity prices, but probably also with respect to the demand to prematurely close Bohunice V1. However, against the backdrop of the growing Western opposition to the Western-led nuclear completion project, the EBRD was unwilling to comply with such requests: Cutting the costs would have implied reducing the scope of the planned safety upgrades at the Mochovce NPP, something various concerned EBRD member countries were loath to accept. Moreover, since it was impossible for the bank to reduce the project costs, the EBRD was reluctant to give in on its condition that electricity prices be sharply raised. Finally, the EBRD regarded the earliest possible closure of Bohunice V1 as a non-negotiable issue.

The effectiveness of the attempted transaction was not hampered by *enforcement problems*. Indeed, since the EBRD failed to conclude a closure deal with the Slovak government, enforcement problems had no effect on the final outcome.

The efficiency of the attempted transaction may have been seriously hampered by the specific *problem-definition* adhered to by the Western donors. Generally speaking, there were two ways by which the Western donors could have employed positive incentives to secure the premature closure of Bohunice V1, i.e. either by funding the completion of Mochovce units 1-2 or by financing the construction of a new gas-fired power plant. Yet from the beginning of the negotiation process the Western donors adhered to a problem-definition that clearly favored pro-nuclear solutions to the nuclear safety problem in the Slovak Republic. Indeed, irrespective of widespread objections that the construction of a gas-fired power plant would be both more economical and environmentally safe, the EBRD appeared to be bent on funding the completion of Mochovce units 1-2. Not surprisingly, the fact that the completion of Mochovce units 1-2 had been found to prevail over the alternative investment option of constructing a gas-fired power plant by only a small margin provoked widespread accusations that EBRD project managers had manipulated the least-cost study to ensure that the nuclear completion project successfully passed the bank's assessment process.

Although the EBRD immediately repudiated such accusations, they received considerable backing in late 1995 as Martin Blaiclock, who was formerly in charge of the EBRD's review of Mochovce proposals, claimed that French government pressures had been brought to bear on the EBRD and that within the bank the then French President, Jacques de Larosière, had actively become involved in the deal (EEE Report Profiles, 1995b: 13; MacLachlan 1996a: 23-24). According to Blaiclock, by mid-1994 widespread protests against the Mochovce completion project and the findings of an initial least-cost study, which favored

the construction of a combined-cycle gas power plant, had made EBRD directors and various member state governments nervous about the outcome. As a result, EBRD President De Larosière allegedly appointed over Blaiclock's head a French EBRD executive as project leader, who was supported by another French national seconded to the project from the French finance ministry. Blaiclock and a senior German economist in the team resigned from the project because of the political interference and claims that the consulting firm Putnam, Hayes & Bartlett had been instructed to rewrite the least-cost study according to assumptions provided by the remaining French project team, which resulted in the nuclear completion project being seen in a more favorable light. In short, if Blaiclock's allegations are true, it is possible to conclude that the commercial interests of a small number of EBRD member countries—in particular of France—prevented the Western donors from pursuing a potentially more cost-effective funding strategy.

The effectiveness of the attempted transaction was not hampered by the "*slippery slope effect"*. Indeed, even if the proposed Western loans for the completion and upgrading of Mochovce units 1-2 had been disbursed, the funding of this specific capacity-building measure could not have had the unintentional effect of enhancing the incentives and/or capacities of the Slovak Republic to continue to engage in undesirable behavior, i.e. to prolong the service lives of Bohunice units 1-2.

Coordination problems among the potential donors and providers of nuclear technology seriously affected the effectiveness of the attempted transaction. To begin with, the whole controversy surrounding the Mochovce completion project testifies to the problem of coordinating disparate national policies of potential donors. On one side of the debate were the French and German governments, which strongly supported the Mochovce completion project not least because French and German firms were bound to profit commercially from the project. Indeed, while EdF could use the Mochovce project as a springboard to similar completion projects in Russia, Bulgaria and Ukraine, the German utilities Bayernwerk and Preussenelektra stood to benefit from cheap electricity imports from the Slovak Republic. On the other side of the debate was a vigorous opposition movement spearheaded by the anti-nuclear Austrian government and various Western environmental pressure groups. This opposition movement sought to prevent international funding for the project because financial support by the EBRD would have likely set a precedent for the completion of similar Soviet-designed reactors elsewhere in CEE and the FSU, which in turn threatened to undermine all efforts to persuade CEE and FSU countries to follow an alternative-energy path.

Uncoordinated actions by Western nuclear firms also hampered the conclusion of a closure deal. As the EBRD was seeking to link loans for the Mochovce completion project to the early closure of Bohunice units 1-2, Siemens signed a $150 million contract to modernize Bohunice V1. Although Siemens argued that its upgrade work did not represent life-extension, in the end its modernization program did have the effect to increase the incentives on the part of the Slovak government to keep the two Bohunice units in operation for as long as possible.

The most serious coordination problem took place among those potential donor countries and firms capable of financing and completing Mochovce units 1-2. Indeed, the Czech-Russian counter-offer to complete the Mochovce NPP both at lower costs and without insisting on substantial loan conditions such as electricity price increases and the premature closure of Bohunice V1 was probably the most important reason why the EBRD's closure deal failed to materialize. The Western donors certainly failed to take into account the potential of Eastern countries to undermine the proposed closure deal. Only a collaborative project with Russian and Czech nuclear engineering firms, under which a major part of the Mochovce completion work would have been awarded to these firms, may have precluded the Czech-Russian counter-offer. Such an option, however, was apparently never seriously considered by the EBRD, most likely because of concerns about the resulting safety standards of such an international project, but also possibly due to the commercial interests of those Western nuclear firms expected to assume a leading role in implementing the Mochovce completion project. In short, the effectiveness of the attempted transaction was seriously hampered by the inability or unwillingness of the Western donors to create a united donor front, comprising all interested countries and firms with the financial and technical means to complete Mochovce units 1-2.

7 CASE STUDY IV: THE ENFORCEMENT OF CLOSURE COMMITMENTS BY THE EUROPEAN COMMISSION

Due to the growing risk that the Slovak Republic, Lithuania and Bulgaria would renege on their unilateral or international closure commitments and prolong the service lives of their high-risk nuclear reactors, the European Commission intervened in the closure debate in late 1998 and sought to enforce closure commitments by extracting "realistic" closure schedules from the three applicant countries. From the outset of closure negotiations, the Commission employed a negative incentive strategy by linking the applicant countries' EU membership prospects to the establishment of "realistic" closure schedules. In addition, during the final stages of the bargaining process the Commission also employed a positive incentive strategy, offering each applicant country a substantial amount of decommissioning aid in exchange for the establishment of "realistic" closure commitments. In late 1999 the closure negotiations were concluded with the following results: The Slovak Republic promised to close Bohunice units 1-2 in 2006 and 2008. Lithuania agreed to abide by its NSA closure commitments, i.e. it pledged to close Ignalina unit 1 by 2005 and to decide on a definitive closure date for unit 2 in 2004. Finally, Bulgaria pledged to shut down Kozloduy units 1-2 in 2003 and to fix a definitive closure date for units 3-4 in 2002. It is expected that Kozloduy units 3-4 will be closed in 2006-2008/10. Whereas Lithuania's closure commitments were fully in line with the Commission's original closure demands, the closure schedules conceded by the Slovak Republic and Bulgaria were somewhat delayed compared to what the Commission had originally demanded.

The outcomes to be explained can be summarized as follows. *Effectiveness*: This outcome varied slightly across the three examined transactions. Whereas the effectiveness of the transaction between the Commission and Lithuania was high, the effectiveness of the other two transactions in which the Commission sought to extract "realistic" closure schedules from the Slovak Republic and Bulgaria was rather high. This assessment is based on the following considerations. On the one hand, it is plausible to suggest that the employment of positive incentives was effective in all three examined transactions. Indeed, although the Commission's negative issue-linkage strategy exerted considerable pressure on the applicant countries to compromise, this strategy was ultimately insufficient to secure "realistic" closure commitments from the applicant countries. In other words, the provision of positive incentives in the form of decommissioning aid was in effect a necessary means to

extract closure commitments from the three applicant countries. On the other hand, the specific closure schedules conceded by the Slovak Republic and Bulgaria—in contrast to those conceded by Lithuania—were not fully in line with the Commission's original closure demands. *Efficiency*: With a view to the fact that no other cooperation strategy and/or way of employing positive incentives could have secured comparable or superior behavioral changes on the part of the three applicant countries at a lower or comparable cost, it can be concluded that the efficiency of the three examined transactions was high, both in terms of the first and second dimension of efficiency. These outcomes were shaped by the following problems. The effectiveness of the two transactions aimed at securing "realistic" closure commitments from the Slovak Republic and Bulgaria was to a certain degree negatively affected by enforcement problems. Indeed, since the enforcement of closure commitments threatened the strategic and commercial interests of various EU Member States and the Western European nuclear industry, the Commission was in effect prompted to accept somewhat later—i.e. less favorable—closure schedules than it had originally demanded.

It should be noted that this case study differs from the other case studies conducted in this book in the sense that it involves the empirical analysis of three distinct transactions between one donor and three different recipients. As already pointed out, I have decided to analyze these three distinct transactions within the framework of one case study because all three transactions materialized in the context of the EU accession process. The case study on the European Commission's ultimately successful attempt to enforce the closure commitments of the three applicant countries is structured along the following lines. The first section provides important background information to the Commission's attempt to enforce the applicant countries' closure commitments. The following three sections analyze the individual bargaining processes between the Commission and each applicant country. The fifth and final section summarizes the results of the case study.

7.1 Genesis and Determinants of the European Commission's Closure Strategy

In seeking to induce the Slovak Republic, Lithuania and Bulgaria to abide by their unilateral or international closure commitments and hence to prevent the prolonged operation of their high-risk nuclear reactors, the European Commission could capitalize on a source of leverage which was in effect only recently available: The possibility to condition these three countries' EU membership prospects—i.e. their chances of beginning EU membership negotiations—on the establishment of "realistic" closure schedules. Indeed, all three countries had officially

applied for EU membership between mid and late 1995, and the EU enlargement process had been formally launched in March 1998. Since the three applicant countries were strongly interested in securing the economic and strategic benefits of EU membership as soon as possible, the Commission certainly reckoned that its proposed issue-linkage strategy would exert considerable pressure on the applicant countries to compromise on the closure issue.

Nevertheless, the extent to which the Commission could successfully capitalize on this source of leverage and push for the earliest possible closure of high-risk nuclear reactors depended on a number of circumstances. To begin with, the Commission had to ensure that its proposed issue-linkage strategy was credible in the eyes of the applicant countries. In other words, this issue-linkage would only be effective if the applicant countries were convinced that there was a firm, non-negotiable nexus between their EU membership prospects and the establishment of "realistic" closure schedules. Second, the Commission faced competing interests within the EU regarding its closure strategy. Indeed, whereas some domestic producers and EU Member States were concerned that the enforcement of closure commitments would threaten their commercial and strategic interests and thus called for an abandonment or relaxation of closure requirements, other industrial and state actors within the EU had strong incentives to ensure that the Commission did not deviate from or soften its closure strategy.

In the following section I elaborate on these circumstances, thereby describing the general background against which the Commission sought to enforce the applicant countries' closure commitments. The first part of this section briefly outlines the EU enlargement process, with a special emphasis on the nexus between the accession process and the closure of high-risk nuclear reactors in applicant countries. The second part explores the various competing interests within the EU that shaped the Commission's closure strategy and ultimately determined its bargaining position vis-à-vis the applicant countries.

EU Enlargement and the Closure of High-Risk Nuclear Reactors

After the revolutions of 1989 and 1991 had radically transformed the political landscape of the European continent and induced the majority of the former socialist states in CEE and the FSU to seek stronger political and economic ties with Western Europe, the EU had come under growing internal and external pressure to consider enlarging its membership towards the East. At the 1993 Copenhagen Council meeting EU heads of state formally welcomed new members from CEE and the FSU provided that they fulfilled a set of economic and

political conditions, the so-called “Copenhagen Criteria”. Plans to enlarge EU membership were further developed at the December 1994 Essen Council meeting which set into motion the process of defining the extensive body of EU legislation—the so-called “Acquis Communautaire”—which each prospective Member State was expected to conform with. After a vast majority of countries from CEE and the FSU had officially applied to join the EU in 1994/95, the December 1995 Madrid Council meeting called on the European Commission to submit an assessment of the candidate states’ applications for membership.

In July 1997 the Commission presented its assessment in a document entitled “Agenda 2000”. In this document the Commission proposed a so-called “two-wave EU enlargement strategy”. Based on the apparent capacity of each candidate country to meet the full range of EU accession criteria, the Commission divided the Eastern European applicant countries into two groups or “waves”. The Czech Republic, Estonia, Hungary, Poland, and Slovenia were assigned to the group of “first-wave” applicant countries. The Slovak Republic, Lithuania, Bulgaria, Latvia and Romania, on the other hand, were categorized as “second-wave” applicant countries. Whereas the Commission recommended to immediately begin EU membership negotiations with the more advanced “first-wave” applicant countries, it deemed the “second-wave” applicant countries to be in need of more advice and preparation. “Agenda 2000” also emphasized the need to improve nuclear safety in CEE and called on applicant countries to respect agreed upon schedules for the closure of first-generation VVERs and RBMKs. Whereas the Slovak Republic was expected to honor its May 1994 resolution to close Bohunice V1 by 2000 or once Mochovce units 1-2 were operational, Lithuania was called on to comply with its commitments made under its 1994 grant agreement with the NSA. With respect to the closure commitments of Bulgaria, the Commission acknowledged that Kozloduy units 1-4 were unlikely to be closed as foreseen by the 1993 grant NSA agreement since certain conditions of the agreement—i.e. the provision of sufficient replacement power—had not yet been fully met. Nevertheless, it called on the Bulgarian government to close Kozloduy units 1-2 in 2001 and units 3-4 in 2001/2002. In short, in “Agenda 2000” the Commission had for the first time formally proposed to link the establishment of “realistic” closure schedules to the EU accession process.

At the December 1997 Luxembourg Council meeting EU heads of state approved the “two-wave EU enlargement strategy” and endorsed a new proposal to reinforce the pre-accession strategy. The aim of this proposal was to increase within the framework of the so-called Accession Partnership Agreements the support for applicant countries in introducing

the reforms required by accession. While the Accession Partnership Agreements called on applicant countries to prepare timetables for adopting the Acquis Communautaire, the EU promised to provide—under the condition that the objectives set out in the timetables had been achieved—the resources and assistance needed to facilitate the accession process. In March 1998 the Commission submitted drafts of the Accession Partnerships for each of the applicant countries. The Commission's demand that the applicant countries establish "realistic" closure schedules was confirmed in the Accession Partnerships with the Slovak Republic, Lithuania and Bulgaria. Moreover, on this occasion the Council requested that the Commission publish annual reports reviewing the progress of reform and the ability of each applicant country to comply with the agreed upon timetables and targets. It was expected that these so-called Accession Progress Reports would be used as the key publications for determining when applicant countries would be prepared to join the EU (Frogatt 1999).

Following the formal launch of the EU enlargement process at a meeting of EU Ministers for Foreign Affairs in late March 1998, the issue of nuclear safety in applicant countries attracted enhanced attention. In August 1998 a seven-member panel of High-Level Advisors, which had been appointed by the Commission to review the EU's nuclear safety assistance programs and to make recommendations regarding the EU's future nuclear safety policies in the applicant countries and the FSU, submitted its final report. The panel's most important findings and recommendations were the following (Panel of High-Level Advisors 1998). First, the expert panel recommended to refrain from imposing conditionality requirements on nuclear safety assistance programs, in particular NPP closure agreements, on the grounds that this strategy had not only been ineffective, but also counterproductive. In addition, the panel voiced doubts about the practical feasibility of linking the accession process to the establishment of nuclear safety standards considered acceptable by EU Member States. These doubts were not unfounded: Due to the absence of a legal document enshrining unified EU nuclear safety standards, the applicant countries had no clear benchmark against which they could judge their own levels of nuclear safety. Despite these rather critical findings, the panel did recommend that the EU continue to insist on the premature closure of first-generation VVERs and RBMKs in the Slovak Republic, Lithuania and Bulgaria.

However, the panel appeared to accept later closure schedules than those originally proposed by the Commission in "Agenda 2000", in particular with respect to Kozloduy units 1-4.[1]

Apparently concerned that the Commission might reconsider or relax its closure requirements, the Austrian government undertook strenuous efforts during its presidency of the European Council of Ministers in the second half of 1998 to ensure that a high level of nuclear safety was linked to the accession process. As a result of Vienna's active lobbying efforts, in December 1998 the Council of Ministers adopted a resolution which endorsed the Commission's demand that the applicant countries close their high-risk nuclear reactors in conformity with the requirements contained in the Accession Partnerships and the NSA grant agreements. Considering that the nexus between the accession process and closure requirements was not uncontested within the EU, this Council resolution represented an important endorsement of the Commission's proposed strategy to link the establishment of "realistic" closure schedules to the applicant countries' EU membership prospects (Frogatt 1999). Finally, by March 1999 the European Parliament had also given its support to the Commission's closure strategy. Indeed, in late February 1999 a special committee of the European Parliament voted in favor of keeping the EU's nuclear safety policies in line with the closure guidelines originally established at the 1992 G-7 summit meeting in Munich, thereby backing the Commission's efforts aimed at securing the premature closure of first-generation VVERs and RBMKs (NW, 25 February 1999: 8-9). Moreover, in early March 1999 the European Parliament endorsed the Commission's requirement that Lithuania and Bulgaria establish "realistic" closure schedules (NW, 1 April 1999: 12-13).

Competing Interests within the EU regarding the Commission's Closure Strategy

In pursuit of its goal to enforce the applicant countries' closure commitments, the Commission was under considerable pressure to take into account competing interests within the EU. On the one hand, an important domestic producer group and various EU Member States were concerned that the enforcement of closure commitments would threaten their commercial and strategic interests and hence sought to induce the Commission to abandon or relax its closure requirements. On the other hand, there were other industrial and state actors

[1] Indeed, whereas the Commission had originally insisted on the closure of Kozloduy units 1-4 by 2001-2002, the expert panel indicated that Kozloduy units 1-2 should be closed once the planned modernization program at Kozloduy units 5-6 was completed, i.e. by around 2004, and refrained from proposing any firm closure deadlines for Kozloduy units 3-4.

within the EU that had strong incentives to ensure that the Commission did not deviate from its original closure strategy. In the following I elaborate on the various competing interests within the EU that shaped the Commission's closure strategy and ultimately determined its bargaining position vis-à-vis the applicant countries.

The Western European nuclear industry represented the most important EU domestic producer group that opposed the Commission's closure strategy. The influence of this industrial group on the nuclear safety policies of Western European governments and the EU cannot be underestimated. Indeed, during the early 1990s the Western European nuclear industry had successfully exploited its considerable organizational clout and the highly complex and technical nature of the nuclear safety problem in CEE and the FSU to define and shape the direction and scope of the Western nuclear safety assistance programs. It is interesting to note that in the early 1990s the Western European nuclear industry had refrained from openly opposing Western efforts aimed at securing the premature closure of first-generation VVERs and RBMKs. In fact, the Western nuclear industry had a vital stake in securing the early closure of the most hazardous Soviet-designed nuclear reactors since another nuclear accident in the East threatened to destroy the commercial future of the Western nuclear industry.

Nevertheless, from the mid 1990s on the Western nuclear industry increasingly opposed Western closure efforts and spoke up for the continued operation of the high-risk nuclear reactors in CEE and the FSU. Exponents of the nuclear industry justified this change of course on the grounds that the West's early closure policy had not only proven to be unsuccessful, but had also become obsolete with a view to the fact that the safety situation at various Eastern European NPPs had improved since the early 1990s. However, the deeper reasons for this change of course were no doubt grounded in the nuclear industry's ongoing commercial crisis. The past decline in orders for new NPPs and the bleak prospects for future construction contracts in the traditional nuclear markets of Western Europe and North America seriously threatened the commercial survival of the Western European nuclear industry. The industry had responded to this alarming situation by seeking business opportunities in the emerging nuclear markets of South-East Asia, China, the FSU and CEE. However, the 1997/1998 financial crises in South-East Asia and Russia and the Chinese government's decision to scale back on its nuclear expansion plans drastically curtailed investment opportunities in these regions. These developments had left CEE as the one and only promising nuclear market for the foreseeable future, and the Western European nuclear

industry was consequently reluctant to see its business prospects in this important nuclear market undermined by Western closure demands.

Specifically, the Commission's closure strategy threatened the commercial interests of the Western European nuclear industry in three respects (Frogatt 1999). To begin with, the nuclear industry was aware that if the first-generation VVERs and RBMKs operating in CEE were to be closed in the near future, Western nuclear firms would lose a considerable share of the funding—critics would say subsidies—provided by the West's nuclear safety assistance programs. Second, the Western European nuclear industry was concerned that the forced closure of a number of high-risk nuclear reactors would lead to a sustained reduction in the nuclear generation capacity of these countries and thus to significantly diminished long-term business opportunities in CEE. This concern was based on the assumption that the enormous capital costs which the applicant countries were likely to incur in the process of complying with the Acquis Communautaire would make it financially impossible for these countries to replace the decommissioned nuclear units with new, capital-intensive nuclear reactors. Finally, the Western European nuclear industry was worried that any strong pressure by the Commission to secure the premature closure of first-generation VVERs and RBMKs would reduce its chances of acquiring much welcomed contracts from Eastern operators, not only for upgrade and construction work, but also for commercial activities in other areas of the nuclear power sector. With a view to the fact that in the Eastern European applicant countries there was often just one state-owned company which operated all nuclear power plants, the nuclear industry's concern that high-level Western pressure on these Eastern operators would undermine their willingness to award contracts to Western firms was not unfounded. In sum, the Western European nuclear industry had strong incentives to lobby the Commission—either directly or via their national governments—into abandoning or at least relaxing its closure requirements.

The Commission's closure strategy also threatened the strategic and economic interests of various EU Member States. A number of EU Member States, in particular from the Nordic region, supported the near-term admittance of new members into the Union. From their perspective, eastward enlargement of the EU promised to generate various strategic and economic benefits, ranging from the promotion of the political and economic reform processes in the former socialist states to the unhindered access for Western European firms to new markets in the East. These EU Member States were thus in favor of a smooth EU accession process. However, the Commission's strategy of tying the applicant countries' EU

membership prospects to the establishment of "realistic" closure schedules threatened to protract and possibly undermine the EU accession process. Indeed, the forced near-term closure of a number of nuclear reactors was likely to create a severe financial burden for the applicant countries and hence compound their difficulties in complying with the EU's economic accession criteria. This created a profound dilemma: While these EU Member States were certainly aware of the safety risks involved in the continued operation of first-generation VVERs and RBMKs, they were also concerned that the Commission's closure strategy would negatively affect their strategic and economic interests by protracting or undermining the EU accession process. As a result, these EU Member States were unwilling to push the issue of accession and reactor closures and sought to induce the Commission to relax its closure requirements.

Whereas the Western European nuclear industry and certain EU Member States called for an abandonment or relaxation of closure requirements, other domestic producers and EU Member States pushed in the opposite direction. The most important industrial group that endorsed the Commission's closure strategy was the Western European electricity producers. The Western European electricity producers had a strong commercial interest in securing the premature closure of various high-risk nuclear reactors because they were concerned that the current applicant countries in CEE would flood the EU with cheap power supplies once they became full-fledged EU Member States. Their concern about the prospect of massive power imports from CEE had been triggered by the combination of three key developments: The construction of links between the previously separated electricity networks of Western and Eastern Europe, the liberalization of the EU's electricity markets and the planned eastward expansion of the EU. In the following I briefly outline these developments and explain why they together generated strong incentives for the Western European electricity producers to support the Commission's closure strategy.

Prior to 1989, there were no interconnections between the various Eastern and Western European electricity networks and hence virtually no electricity was traded between Eastern and Western Europe. However, in the course of the 1990s this situation had changed dramatically. By 1998 the electricity network for the Czech Republic, Hungary, Poland and the Slovak Republic (CENTREL) had been fully integrated into the Western European grid (UCPTE), resulting in an interconnected electricity network known as the Trans European Synchronously Interconnected System (TESIS). Moreover, whereas the Bulgarian grid had been linked to the UCPTE on a trial basis, the planned construction of a transmission line

between Poland and Lithuania was expected to expand the TESIS network further eastwards (Nuclear Energy Institute 2000: 56). Finally, there were ambitious plans to link parts of the FSU's UPS grid to the TESIS network. In short, the construction of links between the previously separated electricity networks of Europe promised to remove for the first time in European history all physical barriers to the free movement of electricity among Eastern and Western European countries (Frogatt 1999).

Another key development related to the liberalization of the EU's electricity markets. In February 1999, the Directive on Rules for the Internal Market in Electricity entered into force. The long-term goal of this directive was the creation of a single European electricity market in which electricity could be freely traded within the EU. Specifically, it required EU Member States to gradually open up their national electricity markets to competition and to allow consumers to purchase electricity from a variety of power producers, including electricity utilities from other EU Member States. Although certain EU Member States, in particular France, had succeeded in watering down the original liberalization plans and were likely to only reluctantly implement the new rules, the directive was nevertheless expected to unleash a strong competitive dynamic in the EU's electricity markets and to gradually lead to the abolishment of all political trade barriers for electricity within the EU.

Against the backdrop of these two developments, the planned eastward enlargement of the EU raised the specter of a massive influx of cheap power imports from CEE (EU Energy Policy, August 1999: 7-8). With a view to the massive investments required for environmental harmonization in the applicant countries—not least for restructuring and modernizing the energy sector in CEE—, the Commission had concluded in "Agenda 2000" that none of the applicant countries could be expected to fully comply with the Environmental Acquis in the near future (European Commission 1997: 65). It was thus widely assumed that the Eastern European applicant countries would be allowed to join the EU without entirely conforming to the Union's environmental rules and standards. This assumption was alarming to the Western European electricity producers because it implied that by the time the applicant countries acceded to the EU and hence enjoyed unrestricted access to the single European electricity market, their power plants would still be operating at lower environmental standards, and consequently also at lower production costs, than the power plants in the existing EU Member States. In other words, the Western European electricity producers were concerned that the disparate environmental standards in an enlarged EU would provide the Eastern European power producers with an "unfair" cost advantage which in turn threatened

to lead to a massive influx of cheap power from CEE into the EU and distort the single European electricity market.[2] What's more, the cost advantage resulting from the disparate environmental standards was likely to accrue in particular to the Eastern European NPPs since in contrast to thermal power plants, for which detailed EU guidelines on air pollution existed, there were no unified EU nuclear safety standards for NPPs (Frogatt 1999). In short, against the background of the three developments outlined above, the Western European electricity producers had strong incentives to lobby for and support measures which mitigated against the distorting impact of EU enlargement on the single European electricity market and limited the "unfair" competition from Eastern European power producers. Not surprisingly, the Commission's strategy to secure the premature closure of high-risk nuclear reactors in the context of the EU accession process represented one such measure.

Finally, the fact that the EU accession process—including the opening of EU membership negotiations with the applicant countries—required the unanimous approval of all EU Member States had a distinct influence on the Commission's closure strategy and bargaining position. Indeed, since each EU Member State could theoretically block the EU accession process on nuclear safety grounds, the Commission was under pressure to take into account the concerns and demands of those non-nuclear EU Member States which were in favor of the earliest possible closure of high-risk nuclear reactors (Frogatt 1999). The position of the anti-nuclear Austrian government was of particular importance in this respect. In pursuit of its policy objective to create a nuclear-free Central and Eastern Europe, the Austrian government had repeatedly insisted on the need for the Eastern European applicant countries to comply with their existing closure commitments in order to qualify for EU membership.[3] Although it was rather unlikely that Austria or other non-nuclear EU Member States would lightly block the EU accession process on nuclear safety grounds, it was still a possibility to be reckoned with, and this possibility exerted strong pressure on the Commission to stick to its original closure strategy and adopt a tough bargaining position vis-à-vis the applicant countries.

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[2] Whereas the average electricity tariff for industrial consumers in CEE was about 25-30 percent lower than in the EU in the late 1990s, residential rates in CEE were roughly three times lower than the EU average. Although these large price differences were expected to decrease in the long-term, in the interim they were bound to generate strong incentives for Eastern European power producers to flood the EU's liberalized electricity markets with cheap power supplies (Frogatt 1999).

In sum, this section has described the general background against which the Commission sought to enforce the applicant countries' closure commitments. On the one hand, this section has shown that by the time or shortly after closure negotiations with the applicant countries were initiated in late 1998 key EU institutions had endorsed the nexus between the EU enlargement process and closure requirements, thereby enhancing the credibility of the Commission's issue-linkage strategy. On the other hand, this section has also shown that the Commission was under considerable pressure to accommodate its closure strategy to various competing interests within the EU, a circumstance which was likely to determine its bargaining position vis-à-vis the applicant countries. In the following three sections the closure negotiations between the Commission and the three applicant countries are examined.

7.2 Closure Negotiations with the Slovak Republic

Since the Slovak government had carried on with the extensive and costly upgrade program at Bohunice V1 regardless of its unilateral commitment to close these two units by 2000 or once the first two units at Mochovce NPP were operational, it had become increasingly clear by 1998 that the Slovak authorities were planning to keep these two VVER-230 units in operation as long as possible. The Slovak government's unofficial plan to postpone the scheduled closure of Bohunice V1 did not go unnoticed by the European Commission. In the November 1998 Accession Progress Report the Commission noted that "the Bohunice Nuclear Power Plant units 1 and 2 are expected to be licensed for long term operation in 1999 after a major upgrading programme" and tartly reminded the Slovak government that "this plan is neither in line with the Accession Partnership nor with a Slovak Government Decree from 1994, which provides for the shutdown of the units 1 and 2 as soon as Mochovce comes into commercial operation" (Frogatt 1999).

Despite the apparent risk that the Slovak authorities were planning to keep the controversial first-generation VVERs at the Bohunice NPP in operation beyond the scheduled closure date, political developments in the Slovak Republic in late 1998 had given rise to hopes that Bratislava would stick to its 1994 unilateral closure commitment. In September

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[3] In July 1999, as closure negotiations with the applicant countries were still under way, the Austrian Council of Ministers issued a position paper which stated that if the applicant countries did not submit comprehensive and convincing closure plans the Austrian government would demand discussions with other EU Member States on the consequences for the accession process (PEE, 8 July 1999: 7).

1998 a new coalition government under Prime Minister Mikulas Dzurinda had been elected which in contrast to its predecessor was determined to bring the Slovak Republic into the front line of the Eastern European applicant countries. In a significant departure from the erratic and authoritarian policies previously pursued under Vladimir Meciar, the new Slovak government immediately undertook strenuous efforts to make up for lost time in meeting EU accession criteria, in particular with regard to democratic practices and the protection of minority rights. Considering that the Commission had stated its disapproval of the unofficial Slovak plan to license Bohunice V1 for long-term operation in the November 1998 Accession Progress Report, it was widely hoped that the new Slovak government would not risk undermining its declared policy goal to begin EU membership negotiations as soon as possible by reneging on the 1994 closure resolution. Nevertheless, these hopes were dashed on 21 April 1999 as the Slovak government officially canceled the May 1994 closure resolution and declared that Bohunice units 1-2 would remain operational as long as they were safe. Since the Slovak nuclear safety authority was convinced that the extensive modernization program at Bohunice V1 would allow the two units to be safely operated for several years beyond their original design lives, the decision of the Slovak government implied that Bohunice units 1-2 would be kept in operation until around 2010-2015.

Various reasons account for the Slovak government's decision to rescind its 1994 closure commitment and to postpone the closure of Bohunice V1. To begin with, the fact that the modernization program at Bohunice V1 had received much praise from international nuclear safety experts at an IAEA conference in Vienna in mid-April 1999 certainly prompted the Slovak government to postpone the scheduled closure of Bohunice V1 (NW, 22 April 1999: 20-21). Moreover, the Slovak government had strong incentives to continue to operate these two units. On the one hand, the Slovak authorities were determined to recoup the considerable amount of money—around $200 million—they had invested over the past years in the extensive and costly upgrade program at Bohunice V1 (PEE, 29 April 1999: 12-13). The continued operation of Bohunice V1 was certainly lucrative from a commercial point of view, not least due to the prospect of exporting power to Western Europe once the Slovak Republic was admitted to the EU and enjoyed unrestricted access to the single European electricity market. On the other hand, the Slovak authorities were reportedly eager to keep Bohunice units 1-2 in operation due to predictions that domestic electricity demand would increase considerably in the near future. Finally, the Slovak government apparently doubted that its decision to postpone the closure of Bohunice would seriously affect its bid for EU

membership. Indeed, the Slovak authorities probably assumed that the successful implementation of the extensive safety upgrade program at Bohunice V1 would induce the Commission to reconsider or at least relax its closure requirements for these two units.

In response to the Slovak government's decision to postpone the scheduled closure of Bohunice V1, the Commission established a bilateral working group to address the Bohunice closure issue. During the following months Commission officials sought to convince the Slovak authorities of the need to establish a "realistic" closure commitment in line with the Accession Partnership Agreement. A first round of closure negotiations in June 1999 ended without any results. Citing the improved safety levels at the Bohunice NPP and the high costs of prematurely closing the two units—estimated at around 1 percent of the country's GDP (FT, 15 September 1999)—the Slovak authorities initially refused to consider closing Bohunice units 1-2 before 2010-2015. During a second round of talks in July and August 1999, the Slovak authorities continued to be intransigent. The only concession they were willing to make at this stage of the bargaining process was to propose closing the two units between 2008 and 2012 under the condition that adequate international funding was made available as compensation for prematurely closing Bohunice V1 (NEI, October 1999: 30).

By early September 1999 the Commission had come under enhanced pressure to break the deadlock over the Bohunice closure issue. Indeed, in recent months various EU Member States had been calling on the Commission to reconsider its "two-wave EU enlargement strategy" and to begin EU membership negotiations with as many Eastern European applicant countries as possible, not least with the Slovak Republic which had made considerable progress in complying with EU accession criteria (RFE/RL Weekday Magazine, 23 September 1999). Since the December 1999 Helsinki Council meeting was expected to decide which of the then current "second-wave" applicant countries would be invited to start EU membership negotiations, the Commission was urged to conclude as soon as possible a closure agreement with the Slovak Republic. Prompted by this internal pressure, the Commission demanded that the Slovak government submit a "realistic" closure plan by 30 September 1999. Moreover, in an attempt to raise the stakes for the Slovak government to compromise, the Commission changed its bargaining strategy in two respects. First, while continuing to insist on the establishment of a "realistic" closure schedule as a precondition to

qualify for EU membership negotiations[4], the Commission definitively abandoned the "Agenda 2000" requirement that Bohunice V1 be closed by 2000 and hinted that it was prepared to accept closure deadlines between 2003 and 2008 (NW, 16 September 1999: 13-15; PEE, 17 September 1999: 13). Second, the Commission signaled its willingness to compensate the Slovak Republic for a positive decision on the Bohunice closure issue. Indeed, although the Commission declined to pay compensation for the economic losses resulting from the premature closure of Bohunice V1, it offered to provide a substantial amount of decommissioning aid from its PHARE program and possibly also from the Euratom loan facility in exchange for a "realistic" closure commitment (NW, 30 September 1999: 10-11; PEE, 1 October 1999: 14).

Within a few weeks the Slovak leadership debated the closure issue and took a final decision: On 27 September the Slovak government announced that it would close Bohunice units 1-2 in 2006 and 2008, i.e. two respectively four years earlier than it had previously proposed in negotiations with the Commission. The Slovak government also indicated that if the Slovak Republic were allowed to join the EU before 2006 and received additional compensation, it would be prepared to close the two units even earlier (NW, 30 September 1999: 10). The latter proposal was certainly meant to be a concession to the Austrian government which unsurprisingly rejected the Slovak government's closure pledge as inadequate and threatened to veto the begin of EU membership negotiations unless the closure dates were brought forward.

Nevertheless, the Slovak government's closure decision was positively received both by the majority of EU Member States and the European Commission, which in its mid-October 1999 Accession Progress Report deemed the proposed closure dates to be in line with "Agenda 2000" and the Accession Partnership. Also in October the promised aid for decommissioning activities at Bohunice V1 was confirmed: The Commission firmly pledged to provide Euro 10 million in 2000 and Euro 20 million each year after that until 2006 from its PHARE program, bringing the total amount of decommissioning aid to Euro 110 million (then about $110 million) (Nuclear Energy Institute 2000: 62). Finally, at the December 1999 Helsinki Council meeting EU heads of state formally invited the Slovak Republic to begin EU membership negotiations.

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[4] In early September 1999 the Commission's chief negotiator in the accession talks, Francois Lamoureux, reminded the Slovak government that a "decision on the closure of these reactors would make the start of accession talks easier" (EEE Report, September 1999: 3).

7.3 Closure Negotiations with Lithuania

By spring 1998 it had become evident that the Lithuanian government was planning to renege on its NSA commitments and to rechannel the two RBMK reactors at the Ignalina NPP for another 15-20 years of operation, i.e. until about 2020-2025. With a view to the economic significance of the Ignalina NPP, it was not surprising that the Lithuanian authorities were concerned that the premature closure of the plant according to the terms of the NSA agreement would be too costly for the hard-pressed country and therefore favored extending the service lives of the two units. Indeed, the Ignalina NPP provided roughly 80 percent of the country's power needs, a contribution that could not easily or cheaply be replaced. In addition, Lithuania lacked the funds necessary for the early decommissioning of the plant. Whereas energy experts estimated that it would require at least $600 million to decommission the plant, the Lithuanian authorities had so far set aside only $25 million for future decommissioning activities (EEE Report, January 1999: 24).

Moreover, the improved prospects of exporting cheap power to Western Europe had increased Lithuania's incentives to keep the Ignalina NPP in operation as long as possible: In February 1998 the Lithuanian government had called an international tender for a strategic investor to construct and operate a transmission line between Lithuania and Poland. An international consortium called Power Bridge subsequently won the tender for the $450 million construction project. Project heads suggested at the time that by 2001 Lithuania could be exporting 6 billion KWh annually to Western Europe, thereby earning up to $150 million a year (Energy Economist, April 1999: 3). Finally, there was continuing uncertainty about when exactly the fuel channels of the two Ignalina units would need to be replaced and the Lithuanian authorities were reportedly convinced that the previous and ongoing upgrade programs had eliminated all major safety problems at the plant.

The major obstacle to the Lithuanian government's unofficial plan to extend the service life of the Ignalina NPP was the opposition of the European Commission. Since early 1998 Commission officials had repeatedly warned the Lithuanian government that Lithuania's EU membership prospects depended on the premature closure of the Ignalina NPP (NW, 9 April 1998: 7). This stance was confirmed in the November 1998 Accession Progress Report in which the Commission demanded that the Lithuanian government make a firm commitment not to rechannel unit 1 of the Ignalina NPP. After the Lithuanian government had unsuccessfully sought to persuade the Commission that it made no sense to tie

Lithuania's EU membership prospects to the premature closure of the Ignalina NPP[5], it adopted a bargaining strategy of demanding substantial compensation payments in exchange for closure commitments.

This bargaining strategy was reflected in the final draft of Lithuania's national energy strategy that the Lithuanian government had issued in December 1998. The draft outlined two so-called "extreme scenarios" for the shutdown of the Ignalina NPP, with one scenario assuming the "forced" closure of the two Ignalina units in 2005 and 2010, and the other scenario assuming fuel channel replacement and continued operation of the two Ignalina units until about 2020 and 2025. The draft also suggested that the government would be in a position to take a final decision on closure dates once the country's nuclear safety authority, Vatesi, had completed the licensing review of unit 1. Although the draft energy strategy indicated that Lithuania was in principle willing to adopt the "forced" closure scenario and hence honor the NSA agreement, it unmistakably warned the Commission that "if the license [for unit 1] is granted and the combined Lithuania and European Commission funding of early closure of the Ignalina plant is not sufficient for all consequences, including the restructuring of the whole electricity supply in the country, it might be necessary to re-channel and continue operation...simply because that would be the only option Lithuania could afford" (NW, 10 December 1998: 15).

Negotiations between the Lithuanian government and the European Commission on the closure of the Ignalina NPP heated up in the early months of 1999 after the government submitted its draft energy strategy to the Lithuanian parliament (Seimas) for debate. The Commission was apparently reluctant to offer compensation in exchange for a Lithuanian closure commitment and once again threatened that Lithuania's EU membership prospects depended on the premature closure of the Ignalina NPP. In response, the Lithuanian Economy Minister, Vincas Babilius, warned the Commission that Lithuania would not be able to specify shutdown dates without international aid commitments,[6] and claimed that Lithuania needed $2.5 billion in foreign aid to close Ignalina unit 1 by 2005 (NW, 25 February 1999: 8). Prime Minister Gediminas Vagnorious made his government's position clear by accusing the

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[5] Lithuanian Prime Minister Gediminas Vagnorius criticized the Commission's issue-linkage on the grounds that the premature closure of NPPs was not included in the Copenhagen criteria, and argued that "an earlier start of the negotiations and accession to the European Union would give additional possibilities to ensure nuclear safety and an earlier shutdown of unit 1" (NW, 12 November 1998: 6).

Commission of pushing the Ignalina closure issue solely for protectionist reasons and declaring that the Lithuanian leadership was not willing to "sacrifice the economy of Lithuania for political motives" (NW, 15 April 1999: 8). In the midst of this controversy, the Seimas decided in mid-April 1999 to postpone its decision on the draft national energy strategy and requested the government to provide more details on the two Ignalina closure scenarios.

The Lithuanian government's determination to resist the pressure exerted by the Commission's issue-linkage strategy and to insist on compensation in exchange for a firm closure commitment was enhanced by two circumstances. To begin with, popular support in Lithuania for EU membership had decreased dramatically since the start of the heated negotiations over the closure of the Ignalina NPP. Indeed, according to an opinion poll conducted in April 1999 by the EC Information Centre, only 27 percent of respondents favored Lithuanian membership in the EU, down from 51 percent in October 1998. These figures clearly indicated that due to widespread concerns that the premature closure of the Ignalina NPP would devastate the country's economy and reduce living standards a large proportion of the Lithuanian population was reluctant to sacrifice the Ignalina NPP to qualify for EU membership (EEE Report, June 1999: 16). The mounting domestic opposition to the forced closure of the Ignalina NPP no doubt strengthened the Lithuanian government's resolve to resist the Commission's closure demands, at least until the Commission offered to provide financial and technical assistance to cope with the costly implications of prematurely closing the two RBMK units. Second, during the past months top Finish and Swedish government officials had assured the Lithuanian leadership of their unconditional support for Lithuania's bid to join the EU and had repeatedly argued that the Ignalina closure issue should not be a stumbling block for the start of EU membership negotiations with Lithuania (NEI, June 1999: 6; NW, 1 July 1999: 16). The diplomatic support granted by these two Nordic EU Member States most likely encouraged the Lithuanian government to stand firm on the closure issue.

In an attempt to reach some compromise on the Ignalina closure issue, the Lithuanian government released in early June 1999 a revised draft of the country's energy strategy. According to the revised energy strategy Lithuania would refrain from rechanneling Ignalina

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[6] Specifically, Babilius argued that "We [the Lithuanian government] can't give an exact date until we know when and how much money will be available [to support closures] and for what specific purposes it must be used" (RFE/RL Weekday Magazine, 22 February 1999).

unit 1 and thus close this unit by 2005. However, by postponing the decision on replacing the fuel channels at Ignalina unit 2 until 2004, the revised energy strategy effectively aimed to keep the future of Ignalina unit 2 open and to avoid any firm commitment to close this unit in the near future (NW, 10 June 1999: 7). The Lithuanian authorities subsequently indicated that they were willing to consider the closure of Ignalina unit 1 according to the timetable set out in the revised energy strategy provided that international assistance was forthcoming. In response, the Commission—apparently concerned that the Lithuanian government would refuse to compromise without international aid commitments—signaled its willingness to discuss financial and technical aid for the shutdown of the Ignalina NPP (NW, 1 July 1999: 16-17).

During the following months closure negotiations focused on the amount of compensation the Commission would have to provide in exchange for a "realistic" closure commitment.[7] In mid-August 1999 the Commission made its first concrete offer to help with the decommissioning of the Ignalina NPP as Francois Lamoureux of the Commission's External Relations Directorate submitted a proposal offering Euro 100 million (then about $100 million) over a six-year period provided that firm closure dates were put forward. Although the Lithuanian government criticized the proposed decommissioning aid as inadequate and insisted on a guarantee that international aid would continue to flow after 2006, the Commission subsequently pushed the Lithuanian leadership to accept this offer as a first step towards larger aid commitments which could be secured at an international pledging conference (PEE, 17 September 1999: 7-8; NW, 26 August 1999: 12-13). In addition, in early September 1999 the EU's new Commissioner for Enlargement, Guenter Verheugen, made it clear to the Lithuanian government that an invitation to begin EU membership negotiations depended on the establishment of firm closure schedules by the end of the year (RFE/RL Weekday Magazine, 28 September 1999).

The prospect of receiving both a substantial amount of decommissioning aid and an invitation to begin EU membership negotiations was apparently sufficient to induce the Lithuanian government to offer for the first time a concrete closure schedule: On 8 September 1999 the Lithuanian government announced that Ignalina unit 1 would be closed by 2005 and that a final decision on a closure date for Ignalina unit 2 would be taken by 2004. The

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[7] The Lithuanian government's bargaining position received a boost in late July 1999 as Vatesi, the Lithuanian nuclear safety authority, decided after much delay to re-license Ignalina unit 1 for another five-year operating period (NW, 5 August 1999: 8).

following day, the then new Lithuanian economy minister, Eugenijus Maldeikis, indicated during a visit to Brussels that Ignalina unit 2 would be closed by 2009 (EEE Report, September 1999: 2-3). The Seimas, which still had to approve the government's revised energy strategy, was bitterly divided over the proposed closure schedules. Indeed, the parliamentary opposition had reportedly assailed the government for being overeager to bow to Brussels' demands and for selling out the country's national interests (RFE/RL Weekday Magazine, 28 September 1999). Nevertheless, on 5 October 1999 the Seimas passed the government's energy strategy with 63 votes to 31, but declared that the closure of Ignalina unit 1 by 2005 depended on the provision of international assistance for decommissioning and for mitigating the social impact of early shutdown (Nuclear Energy Institute 2000: 49). In its mid-October 1999 Accession Progress Report the Commission praised Lithuania's closure commitment as "farsighted and courageous" and stressed its expectation that Ignalina unit 2 would be closed by 2009 (NW, 21 October 1999: 18-19). Finally, at the Helsinki Council meeting in mid-December 1999 EU heads of state confirmed that Lithuania had met the conditions to begin EU membership negotiations.

7.4 Closure Negotiations with Bulgaria

By early 1998 the NSA's closure deal with Bulgaria was on the verge of collapse. On the one hand, it was evident that Bulgaria would not shut down Kozloduy units 1-4 as originally foreseen by the 1993 NSA agreement. Indeed, since the implementation of the various energy projects designed to "trigger" the closure of Kozloduy units 1-4 was far behind schedule, the Bulgarian government was reluctant to close these four first-generation VVERs according to the schedule outlined in the NSA agreement. On the other hand, and even more alarming to the Western donors, the Bulgarian government had signaled its intention to carry out an extensive upgrade program at Kozloduy units 1-4 which would allow these units to operate until the end of their design lives or even beyond. With a view to the fact that Bulgaria had committed itself to the premature closure of Kozloduy units 1-4, the Bulgarian government's plan to upgrade these units for prolonged operation amounted to a clear-cut violation of the NSA agreement.

The Bulgarian government no doubt faced strong incentives to renege on its NSA commitments. Indeed, not only were the costs of decommissioning these units considerable, but the premature closure of Kozloduy units 1-4 would also require investments to provide sufficient replacement power for these four first-generation VVERs—they produced well over

30 percent of Bulgaria's power needs—and entail an increase in fossil fuel imports. An additional reason that enhanced the Bulgarian government's resolve to keep Kozloduy units 1-4 in operation as long as possible was the prospect of boosting the country's power export potential. Indeed, during the past months the Bulgarian government had been seeking to conclude export agreements with Macedonia and Turkey.[8] Finally, the Bulgarian authorities were reportedly convinced that the safety upgrade programs previously conducted at the Kozloduy NPP had removed all cause for concern about the continued operation of the four first-generation VVERs (NW, 23 April 1998: 7-8).

During a series of high-level negotiations in April and June 1998, the EBRD—acting on behalf of the NSA—sought to induce the Bulgarian government to propose a "realistic" closure schedule for Kozloduy units 1-4. Whereas the EBRD rejected Sofia's request to renegotiate the NSA agreement, the bank was reportedly willing to extend the agreement's closure deadlines provided that the Bulgarian national electric company NEK could prove that the continued operation of Kozloduy units 1-4 was needed and represented the least-cost solution to meet Bulgaria's energy needs (NW, 23 April 1999: 7-8). However, these talks foundered on the reluctance of NEK to negotiate in good faith—NEK officials had reportedly presented projections of exaggerated electricity demand increases to justify the long-term operation of Kozloduy units 1-4 (NW, 10 September 1998: 7). Negotiations between the NSA/EBRD and Bulgaria definitively collapsed in mid-September 1998 as the Bulgarian government adopted a new energy strategy which stipulated that Kozloduy units 1-2 would be closed in 2004/2005 and Kozloduy units 3-4 between 2010 and 2012 (EEE Report, September 1998: 5). Realizing that Bulgaria's desire to join the EU was the best leverage the West had to extract a "realistic" closure commitment from the Bulgarian government, the European Commission intervened in the closure debate and warned Sofia that Bulgaria's EU membership prospects depended on the premature closure of Kozloduy units 1-4. This stance was confirmed in the November 1998 Accession Progress Report in which the Commission noted that "Bulgaria must respect its [NSA] commitments and close [Kozloduy] units 1-4 as soon as [Kozloduy] units 5 and 6 have been modernized" (Frogatt, 1999).

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[8] On 7 April 1999 Bulgaria achieved agreement with Macedonia on the construction of a transmission line that was expected to boost Bulgaria's power exports to its Balkan neighbor. Moreover, the Bulgarian government subsequently finalized the terms of an agreement with Turkey under which Bulgaria would export a total of 33.7 TWh between 2000 and 2008. The total value of this power export deal for Bulgaria was then estimated to amount to roughly $1 billion (EEE Report, April 1999: 7-8).

During the following months closure negotiations between the Commission and the Bulgarian government reached an impasse. Indeed, the Commission's repeated warnings that Bulgaria would have to prematurely close Kozloduy units 1-4 to qualify for EU membership negotiations provoked strong resistance by the Bulgarian government. The general sentiment among the Bulgarian leadership was that the Commission's closure demands were unjustified with a view to the fact that safety levels at the Kozloduy NPP had improved since the early 1990s. Bulgarian Prime Minister Ivan Kostov underlined his government's resolve to stand firm on the closure issue by calling the Commission's insistence on the premature closure of Kozloduy units 1-4 "a meaningless diktat" and claiming that "the aggressive demand to close the [Kozloduy] nuclear power plant will destroy even what little competitiveness the country now has" (PEE, 19 March 1999: 4). The Bulgarian government subsequently sought to strengthen its bargaining position in negotiations with the Commission by requesting the parliament to endorse its energy strategy. On 12 March 1999 the Bulgarian parliament met this request by unanimously rejecting the option of closing Kozloduy units 1-4 before the end of their design lives (NW, 18 March 1999: 13).

In an attempt to resuscitate the bogged down negotiations, the Commission sent a delegation to Sofia on 21 May 1999 to discuss various energy scenarios and to identify what alternative power sources were available on what timetable and with what financing (NW, 27 May 1999: 9). Nevertheless, the Bulgarian government remained determined to move on with its plan to modernize Kozloduy units 1-4 for prolonged operation. In response, the Commission warned the Bulgarian government in June 1999 that its approval of a Euratom loan for the modernization program at Kozloduy units 5-6 depended on the establishment of "realistic" closure dates for Kozloduy units 1-4 (NW, 1 July 1999: 15). The Bulgarian government appeared to be unimpressed by this warning, claiming that NEK was both willing and able to finance the costly modernization project with funds from its own greatly improved cash flow if the Commission continued to insist on the establishment of early closure dates in exchange for a Euratom loan (NN, September 1999: 35).

Yet in a significant departure from its previous uncompromising bargaining stance, from September 1999 on the Bulgarian leadership began to signal some flexibility on the closure issue. Indeed, during high-level negotiations on 17 September over Bulgaria's application to join the EU, the Bulgarian government indicated that it would appoint a task force to reconsider electricity demand forecasts—a serious sticking point in negotiations so far. Moreover, during the following weeks Bulgarian negotiators indicated that they were

willing to consider earlier closure schedules for Kozloduy units 1-4 provided that sufficient compensation was forthcoming. Finally, on 4 November 1999 the Bulgarian parliament voted to extend the government's mandate for negotiating with the Commission beyond the parameters laid down in the national energy strategy, thereby authorizing the government to reach an agreement on earlier closure deadlines than those fixed in the energy strategy (PEE, 12 November 1999: 4).

Bulgaria's enhanced willingness to compromise on the closure issue was triggered by the following circumstances. First, from September 1999 on the Commission—under growing pressure by various EU Member States to accelerate Bulgaria's accession into the EU as a means to promote stability in the war-torn Balkan region (RFE/RL Weekday Magazine, 21 July 1999, 2 September 1999)—had begun to signal that it was willing to open EU membership negotiations with Bulgaria on the sole condition that Sofia established "realistic" closure schedules, i.e. irrespective of Bulgaria's progress in meeting other EU accession criteria.[9] This relaxation of the conditions to qualify for EU membership negotiations raised the stakes for the Bulgarian government to compromise on the closure issue. Indeed, the near-term begin of EU membership negotiations had so far been a rather remote possibility for the Bulgarian government, dependent both on its willingness to prematurely close Kozloduy units 1-4 and to make progress in complying with the EU's formal accession criteria. In contrast, from September 1999 on the Bulgarian government could reckon that it would receive an invitation to begin EU membership negotiations at the upcoming Helsinki Council meeting if it complied with the Commission's closure demands. Second, in early October 1999 the Commission had signaled its willingness to provide technical and financial aid to help cope with the decommissioning of Kozloduy units 1-4 (NEI, October 1999: 30). With a view to the fact that during the past weeks the Bulgarian government had made the premature closure of Kozloduy units 1-4 conditional upon adequate external assistance, the Commission's offer to provide aid was no doubt instrumental in enhancing the Bulgarian government's willingness to reach an agreement on the Kozloduy closure issue.

During the remaining weeks of November 1999, the Commission and the Bulgarian government started a new round of negotiations that focused on the specific closure deadlines and on the amount of compensation the Commission would have to provide in exchange for a

Bulgarian closure commitment. The Bulgarian government reportedly offered to close Kozloduy units 1-2 in 2001/2002 under the condition that it received compensation for lost profits and replacement capacity in the order of $80 million per reactor per lost year of operation—i.e. a total of about $500 million—and proposed to postpone a decision on a definitive closure date for Kozloduy units 3-4 until 2004 (PEE, 12 November 1999: 4). The Commission dismissed this closure plan on the grounds that the Bulgarian government was seeking compensation for replacement capacity that Bulgaria did not require, but once again confirmed that it was willing to provide funding for decommissioning projects (EEE Report, November 1999: 7).

Under pressure to reach an agreement before the opening of the Helsinki Council meeting in mid-December 1999, the two negotiating parties were apparently willing to make concessions regarding the closure deadlines and to settle for a compromise. On 29 November 1999 an agreement on the premature closure of Kozloduy units 1-4 was finally concluded: The Bulgarian government pledged to close Kozloduy units 1-2 in 2003 and to fix a definitive closure date for Kozloduy units 3-4 in 2002. Prime Minister Kostov promised that Kozloduy units 3-4 would be closed by 2008/2010. The EU's Commissioner for Enlargement, Guenther Verheugen, indicated that the Commission's understanding was that these two units would be shut down by 2006 (NW, 2 December 1999: 5). In exchange for the new closure schedule, the Commission pledged to provide Euro 200 million (then about $200 million) of financial support between 2000 and 2006 from the PHARE program and agreed to disburse a Euratom loan of up to Euro 250 million for the modernization program at Kozloduy units 5-6.[10] Finally, after the Commission had confirmed that the new closure dates were consistent with the 1993 NSA agreement, the Bulgarian government received an invitation to begin EU membership negotiations at the Helsinki Council meeting.

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[9] On 13 October 1999 the Commission in effect abandoned its "two-wave EU enlargement strategy" as it proposed to begin EU membership negotiations with all current "second-wave" applicant countries. The Commission confirmed that the opening of EU membership negotiations with Bulgaria was conditional upon the establishment of a "realistic" closure date for Kozloduy units 1-4 (EEE Report, October 1999: 1).

[10] The agreement stipulated that the second half of the Euro 200 million grant from the PHARE program would be confirmed in 2002 once definitive closure dates for Kozloduy units 3 and 4 had been agreed upon (PEE, 10 December 1999: 4).

7.5 Assessment

To which extent did the Slovak Republic, Lithuania and Bulgaria change their behavior in a direction desired by the principal donor, i.e. the European Commission? In 1998 the three applicant countries had in effect threatened to renege on their unilateral or international closure commitments by signaling their intention to prolong the service lives of their high-risk nuclear reactors. In an attempt to prevent the long-term operation of Bohunice units 1-2 in the Slovak Republic, Ignalina units 1-2 in Lithuania, and Kozloduy units 1-4 in Bulgaria, the Commission intervened in the closure debate and sought to extract new "realistic" closure commitments from all three countries. In various documents—i.e. "Agenda 2000", the Accession Partnership Agreements and the Accession Progress Reports—the Commission had outlined what it meant by "realistic" closure commitments. With respect to Bohunice units 1-2, the Commission expected the Slovak government to honor its unilateral commitment to close these two units by the year 2000 or once Mochovce units 1-2 were operational. Regarding Ignalina units 1-2, the Commission insisted that the Lithuanian government refrain from rechanneling these two units for prolonged operation and respect its commitments under the 1994 NSA agreement. Finally, with respect to Kozloduy units 1-4, the Commission demanded that the Bulgarian government firmly pledge to close all four units between 2001/2002 and 2004, i.e. by the time the modernization program at Kozloduy units 5-6 was expected to be completed.

After several rounds of intensive negotiations throughout 1999, the Commission succeeded in extracting new closure commitments from the three applicant countries. In late September 1999, the Slovak government agreed to close Bohunice units 1-2 in 2006 and 2008. These closure schedules were delayed compared to what the Commission had originally demanded. In October 1999 Lithuania pledged to close Ignalina unit 1 by 2005 and to decide on a closure date for Ignalina unit 2 in 2004. It is expected that Ignalina unit 2 will be closed by 2009. The Lithuanian government's closure commitments were fully in line with the Commission's original closure demands. Finally, in late November 1999 the Bulgarian government agreed to shut down Kozloduy units 1-4 in 2003 and to fix a definitive closure date for units 3-4 in 2002. It is expected that Kozloduy units 3-4 will be shut down between 2006 and 2008/2010. These closure commitments—in particular for Kozloduy units 3-4—were somewhat delayed compared to what the Commission had originally demanded. Nevertheless, by firmly committing themselves to the premature closure of their high-risk

nuclear reactors, the three applicant countries more or less changed their externality-generating behavior in a direction desired by the Commission.

Which cooperation strategies and what kind of measures were employed by the European Commission to influence the applicant countries' behavior? The principal cooperation strategy by which the Commission sought to induce the applicant countries to refrain from prolonging the service lives of their high-risk nuclear reactors and to close these units as soon as possible was an *issue-linkage*. Throughout the bargaining process, the Commission repeatedly warned the applicant countries that their EU membership prospects—i.e. their chances of beginning EU membership negotiations—depended on their willingness to establish "realistic" closure schedules. It should be noted that during the initial stages of the bargaining process the Commission had made the applicant countries' chances of beginning EU membership negotiations conditional not only on the establishment of "realistic" closure schedules, but also on their capacity to meet EU accession criteria. This issue-linkage was modified from September 1999 on as the Commission signaled its willingness to open EU membership negotiations with the applicant countries on the sole condition that they established "realistic" closure schedules, irrespective of their progress in meeting EU accession criteria.

How can we classify the Commission's strategy of tying the applicant countries' EU membership prospects to the establishment of "realistic" closure schedules? In other words, did the Commission's issue-linkage represent a positive issue-linkage strategy or a negative incentive strategy? This is a rather tricky question. Indeed, the answer to this question ultimately depends on the applicant countries' expectations regarding their EU membership prospects prior to the time the Commission first employed the issue-linkage during the bargaining process. We may state the two possibilities as follows. The issue-linkage qualifies as a positive issue-linkage strategy if the Commission offered to improve the applicant countries' EU membership prospects beyond the level that they had previously expected if they established "realistic" closure schedules. Conversely, the issue-linkage qualifies as a negative incentive strategy if the Commission both threatened to reduce the applicant countries' EU membership prospects beyond the level that they had previously expected if they refused to establish "realistic" closure schedules and offered to maintain their previously expected EU membership prospects only if they established "realistic" closure schedules.

What were the applicant countries' expectations regarding their EU membership prospects prior to the time the Commission employed the issue-linkage? Although the

Commission had repeatedly indicated since July 1997 that the applicant countries would have to abide by their unilateral or international closure commitments to qualify for EU membership, in late 1998 the applicant countries most likely expected—or hoped—that their EU membership prospects depended exclusively on their capacity to meet the EU's political and economic accession criteria. Formally speaking, this view of the EU accession process was not incorrect: Nuclear safety is not a prerogative of the EU and there is no legal document enshrining unified EU nuclear safety standards (EU Energy Policy, August 1999: 7). Be that as it may, the applicant countries most likely perceived the Commission's insistence on reactor closures as an imposition of a new and burdensome condition to qualify for EU membership negotiations. In other words, from the applicant countries' perspective, the Commission's issue-linkage amounted to a threat to reduce their EU membership prospects beyond the level that they had previously expected if they refused to establish "realistic" closure schedules. As such the Commission's issue-linkage is best classified as a negative incentive strategy.

Apart from adhering to a negative incentive strategy, the Commission also employed *normative strategies* in all three examined transactions. At various rounds of bilateral talks Commission officials sought to persuade representatives from the three applicant countries to give up their plans to prolong the service lives of their high-risk nuclear reactors and to comply with their international and unilateral closure commitments. Last but not least, during the final stages of the bargaining process the European Commission offered each applicant country a substantial package of *positive incentives* in the form of decommissioning aid in exchange for the establishment of "realistic" closure schedules. The Commission promised to grant the Slovak Republic Euro 110 million for decommissioning activities at Bohunice units 1-2. Lithuania was expected to receive at least Euro 100 million for the decommissioning of Ignalina units 1-2 and an unspecified amount of additional decommissioning aid at a forthcoming pledging conference. Finally, the Commission promised to grant Bulgaria decommissioning aid in the order of Euro 200 million. In addition, the Commission also

firmly pledged to disburse a Euratom loan of up to Euro 250 million for the modernization of Kozloduy units 5-6.[11]

To which extent were the observed behavioral changes on the part of the three applicant countries influenced by the provision of positive incentives and how high was the effectiveness of the transactions? The empirical analysis of the three transactions suggests that the combined effects of the various cooperation strategies employed by the Commission induced the three applicant countries to establish "realistic" closure schedules. In this respect it must be emphasized that the Commission originally sought to extract "realistic" closure commitments from the applicant countries by employing cooperation strategies other than positive incentives. Only in the final stages of the bargaining process did the Commission provide positive incentives in combination with a negative issue-linkage strategy. Hence, in order to gauge the extent to which the provision of positive incentives influenced the behavioral changes of the applicant countries, it is necessary to first roughly assess the effects of the other two employed cooperation strategies. The employment of normative strategies most likely had no effect on the observed behavioral changes of the applicant countries. Indeed, all three applicant countries had strong incentives to prolong the service lives of their high-risk nuclear reactors: Not only did the continued operation of these reactors promise to generate considerable benefits, but their premature closure and decommissioning threatened to create a severe economic and social burden. With a view to the high opportunity and "real" costs of cooperation, it is plausible to suggest that the Commission's repeated persuasion attempts did not enhance the applicant countries' willingness to establish "realistic" closure schedules. The Commission's negative issue-linkage strategy, on the other hand, did have a significant impact on the applicant countries willingness to cooperate. Since the three applicant countries were strongly interested in securing the economic and strategic benefits of EU membership as soon as possible, the Commission's threat to link the EU accession process to the establishment of "realistic" closure schedules exerted considerable pressure on the applicant countries to compromise on the closure issue.

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[11] The Commission's offer to disburse the Euratom loan does not strictly speaking qualify as a positive incentive because international funding for the modernization of Kozloduy units 5-6 was in effect an integral part of the 1993 NSA agreement. In other words, the Bulgarian government could have expected to receive such loans for the modernization project if it agreed to prematurely close Kozloduy units 1-4. Similarly, the Commission's threat in June 1999 that it would not approve a Euratom loan if the Bulgarian government refused to establish "realistic" closure schedules does not qualify as a negative incentive. Rather, this threat merely sought to reconfirm the existing link between international funding for the modernization project and the closure of Kozloduy units 1-4 and to crush any hopes the Bulgarian government may have had to get around this link.

In order to fully account for the reasons why the Commission's issue-linkage exerted considerable pressure for cooperation, we need to take into account two circumstances. First, the Commission's issue-linkage exerted considerable pressure on the applicant countries to cooperate because it had gained in credibility over time. With a view to the fact that the Commission's issue-linkage strategy was not uncontested within the EU and had attracted criticism from various EU Member States and the influential Western European nuclear industry, it is plausible to suggest that during the early stages of the bargaining process the applicant countries most likely doubted the credibility of the Commission's threat to link these two issues. A lack of credibility would have seriously undermined the potential effects of the issue-linkage. However, the issue-linkage was ultimately credible because the Commission successfully defended its bargaining strategy against all internal and external attempts to de-link the EU accession process from the closure of high-risk nuclear reactors. The Commission's success in rendering its issue-linkage credible can be attributed to a good degree to the internal support provided both by the Western European electricity producers and various non-nuclear EU Member States, in particular Austria, which for either commercial or political reasons insisted that the closure of high-risk nuclear reactors remained firmly linked to the EU accession process.

Second, the issue-linkage exerted considerable pressure on the applicant countries to cooperate because the Commission eventually modified the conditions for EU membership negotiations. Indeed, from September 1999 on the Commission offered the applicant countries the opportunity to begin EU membership negotiations on the sole condition that they established "realistic" closure schedules, i.e. irrespective of their progress in meeting the EU's formal accession criteria. This modification of the conditions for EU membership negotiations raised the stakes for the applicant countries to compromise on the closure issue. In particular for Bulgaria, but also for Lithuania, the near-term begin of EU membership negotiations had so far been a rather remote possibility, not least due to their lack of progress in complying with the EU's formal accession criteria. By contrast, in autumn 1999 EU membership negotiations had become a distinct possibility for the applicant countries, provided that they established "realistic" closure schedules. The Commission's decision to modify the conditions for EU membership negotiations had been triggered by a change in EU enlargement strategy. In the wake of the Kosovo war (March—June 1999) various EU Member States had adopted a more strategic view of EU enlargement, i.e. eastward enlargement of the EU was increasingly perceived as a strategic means to promote stability on

the EU's borders. This strategic view of EU enlargement pertained in particular to Bulgaria due to its geographical location in the chronically unstable Balkan region, but was subsequently extended to other applicant countries. Hence, from mid-1999 on there was an enhanced sense of urgency on the part of various EU Member States to accelerate the accession process and provide the Eastern European applicant countries with a "European perspective". This change in EU enlargement strategy exerted strong pressure on the Commission to abandon its "two-wave EU enlargement strategy" and to initiate EU membership negotiations with all applicant countries. The Commission thus agreed to suspend most of its conditions for EU membership negotiations, with the exception of its demand that the applicant countries establish "realistic" closure schedules.

In short, the Commission's negative issue-linkage strategy was no doubt instrumental in inducing the applicant countries to cooperate. On the other hand, this assessment does not imply that the observed behavioral changes of the applicant countries can be exclusively attributed to the effects of the issue-linkage. To begin with, it is doubtful whether the issue-linkage was sufficient for inducing the applicant countries to establish "realistic" closure schedules. In other words, it is rather likely that the applicant countries would have refused to cooperate if the Commission had resorted exclusively to the issue-linkage. The empirical analysis of the closure negotiations with Lithuania suggests that this possibility was not far-fetched. In early 1999 the Lithuanian government had indicated that it would refrain from rechanneling Ignalina units 1-2 and honor its NSA closure commitments provided that external assistance was forthcoming. The Commission initially ignored these compensation demands and reiterated its warning that Lithuania's EU membership prospects depended on the premature closure of the Ignalina NPP. As a result of the Commission's uncompromising bargaining stance, public support in Lithuania for EU membership dropped significantly. The crumbling public support for EU membership suggests that the Lithuanian government faced mounting domestic pressure not to give in to the Commission's closure demands—at least not until the EU provided financial assistance to help cope with the costly implications of the plant's closure. It is hence likely that the Lithuanian government would have refused to abide by its NSA closure commitments if the Commission had refrained from offering decommissioning aid and exclusively employed the issue-linkage.

Moreover, even if we assume that the issue-linkage ultimately did induce the applicant countries to compromise on the closure issue, it is likely that the Commission would have had to settle for far less favorable closure commitments—i.e. later closure deadlines—if it had

resorted exclusively to the issue-linkage. This assessment pertains in particular to the closure negotiations with the Slovak Republic and Bulgaria. On the one hand, it is certainly true that the Commission's issue-linkage was instrumental in inducing the Slovak and Bulgarian governments to negotiate over the premature closure of their high-risk nuclear reactors. On the other hand, it is far from clear whether or to which degree the specific closure deadlines the Slovak and Bulgarian governments conceded in late 1999 can be attributed to the pressure exerted by the issue-linkage. With a view to the fact that the Slovak and Bulgarian governments had insisted that the closure deadlines depended on the amount of compensation the Commission was willing to provide, it is rather unlikely that the issue-linkage was exclusively or even primarily responsible for securing these more or less satisfactory closure schedules. In sum, it is plausible to suggest that the Commission would have secured far less favorable closure schedules or perhaps none at all if it had refrained from offering compensation and only employed the issue-linkage.

The arguments above suggest that the provision of positive incentives in the form of decommissioning aid made the difference between success and failure. The employment of positive incentives was thus necessary to induce the applicant countries to establish closure schedules more or less in line with the Commission's original closure demands. Indeed, the three applicant countries had insisted on some sort of compensation in exchange for their willingness to incur the costs of cooperation. It is thus highly likely that the applicant countries would have established far less favorable closure schedules or would have even refused to cooperate if the Commission had refused to provide positive incentives. This finding suggests that the employment of positive incentives was effective in driving the applicant countries' behavior in a direction desired by the Commission. Nevertheless, it must be taken into account that in contrast to the closure commitments conceded by the Lithuanian government, the closure commitments offered by the Slovak and Bulgarian governments were not fully in line with the Commission's original closure demands. This leads us to the following conclusions regarding the effectiveness of the examined transactions. Whereas the *effectiveness* of the transaction between the Commission and Lithuania was high, the *effectiveness* of the two other transactions was rather high.

How high was the efficiency of the three examined transactions? In assessing the *first dimension of efficiency*, we need to take into account that the Commission employed positive incentives in combination with a negative issue-linkage strategy. Hence, in order to assess the first dimension of efficiency, we need to address the following question: Could the

Commission have secured comparable or superior behavioral changes on the part of the three applicant countries—i.e. earlier closure deadlines—at a lower or comparable cost by employing another cooperation strategy in tandem with the negative issue-linkage strategy? On the basis of the evidence available, I would answer in the negative. To begin with, it is difficult to see how the Commission could have resorted to a positive issue-linkage strategy. Indeed, the Commission already employed an issue-linkage strategy, albeit one that was designed to increase the applicant countries' costs of non-cooperation. Theoretically, the Commission could have converted its negative issue-linkage strategy into a positive issue-linkage strategy by offering the applicant countries significantly enhanced EU membership prospects—i.e. in effect an invitation to join the EU—in exchange for the establishment of "realistic" closure commitments. However, such a positive issue-linkage was politically impractical because it would have undermined the foundations of EU enlargement that conditioned EU membership on the respective applicant country's ability to comply with the Acquis Communautaire.

Conversely, the Commission could have sought to further raise the costs of non-cooperation by broadening its already employed negative issue-linkage strategy to include the threat of economic sanctions. However, with a view to the strategic interests of various EU Member States in promoting eastward enlargement of the EU, it is doubtful whether the Commission would have been able or willing to resort to such a measure that involved the serious risk of undermining the accession process. Moreover, it is rather unlikely that the threat of economic sanctions would have led to comparable or superior behavioral changes on the part of the applicant countries. On the contrary, with a view to the fact that the Commission's negative issue-linkage strategy already exerted considerable pressure on the applicant countries, it is rather likely that the additional threat to impose economic sanctions in the event of non-cooperation would have stiffened the applicant countries' resistance to closure demands and may have led them to opt out of closure negotiations. Finally, it is difficult to see how the employment of normative or cognitive strategies in combination with the Commission's issue-linkage could have led to more favorable outcomes. Indeed, neither persuasion attempts nor the provision of more complete information on the full costs and risks of prolonging the operation of high-risk nuclear reactors would have enticed the applicant countries to establish "realistic" closure schedules. In short, the three examined transactions were efficient in the sense that the Commission could not have secured a more favorable

result by employing an alternative cooperation strategy in combination with its negative issue-linkage strategy.

As far as the *second dimension of efficiency* is concerned, the empirical analysis suggests that the efficiency of the three examined transactions was high. Indeed, it is unlikely that the Commission could have secured comparable or superior behavioral changes on the part of the applicant countries at a lower or comparable cost by employing positive incentives in different ways. The following reasons explain why the provision of decommissioning aid was the most cost-effective way of employing positive incentives. First, by pledging to defray a significant part of the decommissioning costs, the Commission addressed one of the main reasons why the applicant countries were reluctant to prematurely close their high-risk nuclear reactors. Indeed, the considerable financial costs and technical complexities of decommissioning nuclear reactors had seriously impinged on the applicant countries' willingness to cooperate. In contrast, the provision of financial and technical aid to construct power replacement capacity—while certainly helpful in softening the impact of reactor closures on the applicant countries' energy situation—would have not directly addressed this key cooperation problem. Second, the decommissioning aid pledged by the Commission was inextricably linked to the closure of high-risk nuclear reactors. This characteristic of the pledged aid enhanced the prospects of successful cooperation because the recipient countries had no opportunities to misuse the pledged decommissioning aid to continue to engage in undesirable behavior.

To which extent did the theoretically predicted problems in designing and implementing positive incentives shape the effectiveness and efficiency of the transactions? Neither the effectiveness nor the efficiency of the three examined transactions was negatively affected by *extortion problems*. This conclusion may be surprising when taking into account that the applicant countries had implicitly threatened to prolong an already existing negative externality—i.e. to extend the service lives of their operational high-risk nuclear reactors—if not compensated for refraining from doing so. Nevertheless, the applicant countries' behavior does not qualify as extortion. Indeed, the three applicant countries had a genuine interest in prolonging the service lives of their high-risk nuclear reactors. From their perspective, the benefits to be gained from prolonging the operation of these units clearly exceeded the involved environmental costs, not least due to the fact that the previous safety upgrade programs funded by the Western donors had reduced the risk of a nuclear accident at one of these units. It is thus highly likely that the applicant countries would have delivered on their

implicit threat to continue to operate these unsafe units if the Commission had not provided compensation in the form of decommissioning aid. In short, the applicant countries did not bluff the Commission into providing positively valued resources in exchange for risk-eliminating behavioral changes that they would have undertaken even if the Commission had refused to provide such resources. In addition, this potential problem did not deter the Commission from engaging in transactions with the three applicant countries.

Moral hazard problems also did not negatively affect the outcomes to be explained. True, it is plausible to suggest that by postponing the scheduled closure dates for Kozloduy units 1-4 and Bohunice units 1-2 the Bulgarian and Slovak governments in effect engaged in risky activities that exposed the West to elevated levels of nuclear risk. On the other hand, it is unlikely that the Bulgarian and Slovak governments postponed the scheduled closure dates because they expected or hoped that the Commission would provide the necessary resources to reduce to an acceptable level the risks resulting from the continued operation of their first-generation VVERs. As a matter of fact, the Bulgarian and Slovak government's willingness to invest a considerable amount of their own resources in the modernization of their high-risk nuclear reactors suggests that they did not expect to gain (additional) risk-reducing nuclear safety assistance from the West by postponing the scheduled closure schedules. In short, the behavior of the Bulgarian and Slovak governments does not qualify as moral hazard and did not have any impact on the effectiveness and efficiency of the transactions.

The effectiveness of the examined transactions was not seriously affected by *information and distribution problems*. It should be noted that this assessment does not imply that these problems were absent in the closure negotiations. Indeed, the Commission did encounter difficulties in determining the applicant countries' "real" preferences regarding the near-term closure of high-risk nuclear reactors, not least due to the applicant countries' apparent reluctance to comply with their existing closure commitments. Moreover, the applicant countries also sought to gain the maximum amount of compensation in exchange for the least costly environmental measures, i.e. the latest possible closure schedules. However, these information and distribution problems neither seriously delayed nor prevented the conclusion of closure negotiations. An important reason why these problems did not seriously affect the effectiveness of the transactions was the fact that the Commission had set a tight deadline for the establishment of "realistic" closure schedules, i.e. prior to the December 1999 Helsinki Council meeting. This tight deadline served to limit the time to haggle over the size and composition of compensation payments as well as over specific closure schedules.

Enforcement problems negatively affected the effectiveness of at least two of the three examined transactions. As pointed out above, the closure schedules ultimately conceded by the Slovak and Bulgarian governments were somewhat delayed compared to what the Commission had originally demanded. Considering that the Commission disposed over considerable bargaining leverage, it is rather surprising that it did not succeed in extracting closure commitments from the Slovak Republic and Bulgaria that corresponded more closely with its original closure demands. Hence, what explains the fact that these two transactions were not fully effective?

The principal reason why the Commission's enforcement attempt was not completely successful in these two transactions relates to the fact that the Commission had faced steadily growing internal pressure to relax its closure requirements. This pressure emanated, on the one hand, from the commercial interests of the Western European nuclear industry. Since the forced closure of various nuclear reactors in CEE and the FSU threatened to have detrimental effects on the Western European nuclear industry's near- and long-term business opportunities, this influential industrial group had strong incentives to lobby the Commission—either directly or indirectly via their respective national governments—into abandoning or at least into softening its early closure policy. It is hence plausible to suggest that the commercial interests of the Western European nuclear industry had a certain effect on the Commission's willingness to relax its closure requirements and settle for compromises. On the other hand, the pressure exerted on the Commission to relax its closure requirements also derived from the strategic interests of various EU Member States in firmly tying the Eastern European applicant countries into the EU accession process. Since the Commission's strategy of linking the applicant countries' EU membership prospects to the establishment of "realistic" closure schedules had provoked strong resistance on the part of the applicant countries, various EU Member States had become concerned that the Commission's uncompromising stance on the closure issue would protract or possibly derail the EU accession process. It is hence plausible to suggest that various EU Member States exerted pressure on the Commission to adopt a more flexible bargaining stance in order to minimize the strategic risks involved in enforcing closure commitments. In short, the efforts by the Western European nuclear industry and various EU Member States to safeguard their commercial and strategic interests gave rise to enforcement problems that impinged on the effectiveness of two examined transactions.

It should be noted that the Commission's attempt to enforce Lithuania's closure commitments posed similar threats to the commercial and strategic interests of the Western European nuclear industry and various EU Member States. However, enforcement problems did not negatively affect the effectiveness of this transaction. This finding has much to do with the fact that it was virtually impossible for the Commission to adopt a more flexible bargaining stance vis-à-vis the Lithuanian government. Indeed, the Commission either insisted that the Lithuanian government refrain from rechanneling Ignalina units 1-2 and close the plant in line with its NSA closure commitments, or it yielded to the Lithuanian government's plans to rechannel these two units and accepted that the Ignalina NPP would continue to operate for another 15-20 years. Given the alarming prospects of the latter option, it is reasonable to suggest that in this specific transaction the Commission faced less internal pressure to relax its closure requirements.

The specific *problem-definition* adopted by the Commission did not hamper the efficiency of the examined transactions. Indeed, the Commission's decision to enhance the applicant countries' capacities and incentives to prematurely close their high-risk nuclear reactors by employing positive incentives for decommissioning work was not dictated by the political or commercial interests of EU Member States or domestic producer groups. Rather, the Commission most likely decided to fund the implementation of this specific capacity-building measure because it promised to be the most cost-effective way to secure the premature closure of high-risk nuclear reactors under the given circumstances.

The *„slippery slope effect"* did not hamper the effectiveness of the examined transactions. This conclusion is evident: Since the aid pledged by the Commission was earmarked for decommissioning work and was as such inextricably linked to the closure of high-risk nuclear reactors, it did not enhance the incentives or capacities of the recipient countries to continue to engage in undesirable behavior, i.e. to prolong the operation of their high-risk nuclear reactors.

Coordination problems did not negatively affect the effectiveness of the examined transactions. This finding has much to do with the fact that the European Commission was the sole donor in the examined transactions. Indeed, the fact that the Commission was authorized to negotiate over closure commitments on behalf of all EU Member States prevented both burden-sharing problems among the Western donors and the pursuit of conflicting national strategies aimed at securing "realistic" closure commitments from the applicant countries.

8 CASE STUDY V: THE INTERNATIONAL EFFORT TO SECURE THE PREMATURE CLOSURE OF THE CHERNOBYL NPP IN UKRAINE

Prior to the time Ukraine gained national independence from the Soviet Union in late 1991, the Ukrainian leadership had resolved to prematurely close the ill-fated Chernobyl NPP by the end of 1993. However, this proved to be a short-lived victory: In October 1993 the Ukrainian parliament rescinded its previous closure resolution and approved the government's plans to extend the service lives of the two remaining operational nuclear reactors at the Chernobyl NPP (units 1 and 3). Moreover, in early 1994 the Ukrainian government signaled its intention to restart Chernobyl unit 2, which had been shut down in 1991 as a result of a major fire in the unit's turbine hall. Deeply concerned about the prospect of the crippled Chernobyl NPP being modernized for long-term operation, the Western countries subsequently sought to induce the Ukrainian government to close Chernobyl units 1 and 3 as soon as possible and to refrain from restarting Chernobyl unit 2. In December 1995, after nearly two years of intensive negotiations, the G-7, the European Commission and the Ukrainian government signed a Memorandum of Understanding (MoU) in which the West agreed to provide $2.3 billion in assistance in exchange for the closure of the Chernobyl NPP by 2000. The MoU envisaged around $500 million in grants for various projects related to the plant's early closure and $1.8 billion in loans for the completion of the two partly built Khmelnitsky-2 and Rovno-4 reactors (K2/R4) and the modernization of existing hydroelectric and thermal power plants.

Implementation of the December 1995 MoU proved to be a bumpy and protracted process. After having agreed to close Chernobyl unit 1 in November 1996, the Ukrainian government became increasingly irritated with the delays on the part of the Western donors to provide the promised loans for the K2/R4 project. As a result the Ukrainian government repeatedly threatened to restart the second unit of the Chernobyl NPP and to postpone the closure of unit 3 if the K2/R4 project was not completed on schedule. To render its latter threat more credible, the Ukrainian authorities undertook strenuous efforts to keep Chernobyl unit 3 operational, despite the fact that the reactor was in perpetual need of repairs and clearly unfit for continued operation. Not least due to the ongoing failure of the Western donors to approve loan financing for the nuclear completion project, the Ukrainian government decided in late 1999 to keep Chernobyl unit 3 in operation, which was certainly undesirable from the Western donors' perspective. Nevertheless, the Ukrainian government subsequently realized that its threat to postpone the closure of the plant was unlikely to accelerate the approval of

loans for the K2/R4 project and might even jeopardize the provision of Western assistance for other Chernobyl-related projects. Hence, in June 2000 Ukrainian President Kuchma agreed to close the remaining operational reactor of the Chernobyl NPP by December 2000. The Chernobyl NPP was duly shut down on 15 December 2000, a few days after the Western donors had tentatively agreed to provide over $1.2 billion in loans for the completion of the Khmelnitsky-2 and Rovno-4 reactors.

The outcomes to be explained can be summarized as follows. *Effectiveness*: Since the provision of a comprehensive package of positive incentives ultimately induced and enabled the Ukrainian government to close the Chernobyl NPP, albeit somewhat later than the Western donors had preferred to see, the effectiveness of the transaction was rather high. *Efficiency*: The transaction was efficient in the sense that the Western donors could not have attained a more favorable result by employing alternative cooperation strategies. On the other hand, it is likely that the Western donors could have secured at least a comparable behavioral change on the part of Ukraine at lower cost by employing positive incentives in different ways. As such the efficiency of the transaction (second dimension) was rather low. These outcomes were shaped by the following problems. Whereas the effectiveness of the transaction was to a certain extent hampered by information, distribution and coordination problems, the efficiency of the transaction (second dimension) was negatively affected by the pro-nuclear problem-definition adopted by the Western donors.

The case study on the international effort to secure the premature closure of the Chernobyl NPP is structured along the following lines. The first section elaborates on the reasons why the Ukrainian leadership revoked its previous anti-nuclear policy and opted for the continued operation of the Chernobyl NPP. The second section examines the bargaining process that led to the conclusion of the December 1995 MoU in which the West pledged $2.3 billion in assistance in exchange for the closure of the Chernobyl NPP by 2000. The third section explores the problem-ridden implementation of the MoU. The fourth and final section summarizes the results of the case study.

8.1 The Rise and Fall of Ukraine's Anti-Nuclear Policy

The April 1986 nuclear disaster at the Chernobyl NPP and its subsequent handling by Soviet authorities—Moscow had initially sought to conceal the fact that a serious nuclear accident had occurred—had given rise to a powerful anti-nuclear power movement in various republics of the then existing Soviet Union. The anti-nuclear power movement subsequently took

advantage of the increased possibilities for political participation in the era of Perestroika and Glasnost in the late 1980s and pressed the Soviet government into revoking its ambitious nuclear power program. As a result, by 1990 the Soviet government had halted the completion of various reactors under construction and decided to close the Medzamor NPP in Armenia.[1]

The anti-nuclear power movement was particularly strong in Ukraine, which along with Belarus had suffered most from the radioactive fallout of the nuclear meltdown at the fourth unit of the Chernobyl NPP. Outright concern about the safety of the Soviet-designed nuclear reactors operating in Ukraine was certainly a motivating factor, but not the only one: Since many Ukrainians blamed the 1986 nuclear disaster on the Soviet government, opposition to nuclear power became a populist stance associated with anti-communism and the desire to throw off the Soviet yoke (Marples 1996a: 23). Proponents of Ukrainian statehood did not miss the opportunity to capitalize on such feelings to promote their political agenda. Shortly after its declaration of sovereignty in July 1990—Ukraine remained a republic of the Soviet Union until it gained full national independence on 1 December 1991—, the newly elected Ukrainian parliament imposed a five-year moratorium on the construction of new nuclear units and voted in favor of closing the three remaining operational reactors at the Chernobyl NPP by the end of 1995. Following a major fire in the turbine hall of Chernobyl's second unit in October 1991, which had raised the specter of another nuclear disaster, the Ukrainian parliament decided to shut down Chernobyl unit 2 immediately and to close Chernobyl units 1 and 3 by the end of 1993 (NEI, December 1991: 2; NN, December 1991: 48).[2]

The Ukrainian parliament's closure decrees had given rise to hopes in the West that one of Europe's most serious nuclear safety threats would soon disappear. These far-flung Western hopes, however, gradually faded in the months following Ukraine's independence as the Ukrainian leadership began to reconsider its anti-nuclear policy. Indeed, already by the end of 1992 Ukrainian officials had been warning that it would be impossible to meet the country's energy needs if the nuclear moratorium was upheld and the Chernobyl NPP closed on schedule (NW, 31 December 1992: 11-12). Throughout 1993 the fate of the Chernobyl

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[1] For a comprehensive account of the rise and fall of the anti-nuclear power movement in the Former Soviet Union, see Dawson (1996).

[2] Even the then mayor of Slavutich, the town built near Chernobyl to house the station's workforce, had expressed his understanding for the Ukrainian parliament's decision to bring forward the closure date of the Chernobyl NPP, arguing that the continued operation of the ill-fated plant was a psychological burden that the average Ukrainian citizen found hard to bear (NW, 23 July 1992: 14).

NPP was fiercely contested among Ukrainian politicians and government agencies, leaving the West worried about the outcome of the domestic debate. Western concerns were definitively confirmed on 21 October 1993 as the Ukrainian parliament, completely ignoring the opinion of the country's fledgling nuclear safety authority, rescinded the nuclear moratorium and Chernobyl closure resolution and approved the government's plans to modernize and prolong the service lives of Chernobyl units 1 and 3. Moreover, in early 1994 the Ukrainian government approved the nuclear industry's plans to repair and restart Chernobyl unit 2 as well (NW, 28 October 1993: 1, 10-12; NW, 7 April 1994: 10-11; Nuclear Energy Institute 1997: 183).

Why did the Ukrainian leadership revoke its previous anti-nuclear policy and opt for the continued operation of the troubled Chernobyl NPP? This policy change was in part triggered by Ukraine's deepening economic crisis following the attainment of full national independence. Between 1991 and 1994 Ukraine's economy had come close to collapsing under the collective weight of hyperinflation, a near-worthless currency, the disruption of former Soviet bloc trade links, and a huge decline in industrial production. Ukrainian GDP dropped by a dramatic 50 percent during this time period (Ebel 1997: 274-275; IEA 1996: 39). Beleaguered by a major economic crisis, Ukraine could not easily afford to close the Chernobyl NPP. Indeed, the significant costs and technical complexities involved in decommissioning the Chernobyl NPP and cleaning up the severely contaminated site exceeded the destitute country's financial and technical capacities by lengths. In addition, the Ukrainian leadership was also concerned about the social costs of closing the Chernobyl NPP. Since there were virtually no alternative employment opportunities for the approximately 5'000 strong Chernobyl workforce and with no social safety net in place, the early closure of the plant threatened to create severe social problems among the 23'000 residents of the company town Slavutich.

The Ukrainian leadership's decision to keep the Chernobyl NPP in operation beyond the scheduled closure date was also closely connected with a fundamental reappraisal of nuclear power in Ukraine—a reappraisal that had been triggered by the country's critical energy situation in the wake of independence. Ukraine lacked substantial indigenous energy supplies other than low quality coal and uranium deposits and was able to meet only around 23 percent of its oil requirements and 19 percent of its natural gas needs through domestic production (Ebel 1997: 280). Ukraine therefore had to import roughly 80 percent of its oil and natural gas needs, a large part of which was supplied by the Russian Federation. Prior to

gaining independence in late 1991, Ukraine could count on vast amounts of cheap fossil fuel supplies from the Soviet Union to meet its energy needs. However, following the break-up of the Soviet Union in December 1991, the Russian Federation was no longer willing to deliver subsidized energy supplies and began to charge its former Soviet neighbors higher prices for energy. Russia's new energy policy had serious implications for Ukraine's energy situation. Indeed, not least due to its growing difficulties in paying for Russian fossil fuel imports, Ukraine had found itself in the midst of an acute energy shortage after gaining independence. The Ukrainian leadership hence soon realized that Ukraine could not easily dispense with nuclear power. In fact, the Ukrainian government opted to deepen the country's reliance on nuclear power: Whereas Ukraine's 14 operational nuclear reactors accounted for roughly 25 percent of the country's total electricity supply in 1991, this figure had risen to 34 percent in 1994 (Ebel 1997: 301).[3]

Ukraine's enhanced reliance on nuclear power was to large extent determined by economic factors. Indeed, nuclear power was estimated to cost about 20 percent less than the electricity produced at the country's thermal power plants (NEI, April 1996: 13). The relative cost advantage of nuclear power derived not only from the comparatively high costs of imported fossil fuels, but also from the fact that the most expensive component of nuclear power, i.e. the capital costs for the construction of a nuclear facility, could be written off by virtue of Ukraine having inherited the plants from the Soviet Union. In this respect it made economic sense to squeeze out as much power from these Soviet "gifts" as possible (Economist, 24 July 1993: 20). Ukraine's growing reliance on nuclear power was also determined by strategic considerations. By August 1993 Ukraine had accumulated debts for Russian natural gas deliveries in the order of $120 million (Markus 1995: 16). Ukraine's growing gas debts did not only have critical implications for the security of its energy supply—Russia had decreased gas supplies for the first time in late August 1993—but was also perceived by the Ukrainian leadership as increasing the country's political vulnerability vis-à-vis Moscow and jeopardizing its fragile independence at a time when relations between

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[3] The country's 14 operational nuclear reactors (as of late 1993) were located at five NPP sites. Chernobyl NPP: Two RBMK-1000s (units 1 and 3; unit 4 was destroyed in 1986 and unit 2 was closed in 1991). Khmelnitsky NPP: One VVER-1000 (unit 1). Rovno NPP: Two VVER-213s (units 1-2) and one VVER-1000 (unit 3). South Ukraine NPP: Three VVER-1000s (units 1-3). Zaporozhe NPP: Five VVER-1000s (units 1-5). Due to the surge of the anti-nuclear movement in the late 1980s, construction work on three almost finished VVER-1000s—Zaporozhe unit 6, Khmelnitsky unit 2, and Rovno unit 4—had been halted in 1990 (Ebel 1995: 41).

Ukraine and the Russian Federation were seriously strained by various bilateral disputes.[4] Indeed, throughout 1993 Moscow had attempted to exploit the gas debt issue to gain political concessions from Kiev.[5] Consequently, Ukraine had sought to reduce its dependence on Russian fossil fuel imports by relying more heavily on domestically produced nuclear power.

In short, the Ukrainian leadership's decision to keep the Chernobyl NPP in operation must be viewed in the context of a general revaluation of nuclear energy in Ukraine. In the wake of independence, which had confronted Ukraine with a host of new political and economic challenges, the hard-pressed country no longer denounced its nuclear reactors as ugly manifestations of Soviet imperialism, but increasingly regarded them as "valuable bulwarks of national independence in a world where Russia controlled most other sources of energy" (Darst 1997: 61-62). This view pertained even to the ill-fated Chernobyl plant. Indeed, even though the amount of power generated by the Chernobyl NPP accounted for only about 6 percent of the country's total electricity supply, this was still a considerable amount of energy to forego at a time when Ukraine was struggling to cope with an acute energy shortage and when Russia was eager to exploit Ukraine's massive natural gas debts to gain political concessions in other outstanding bilateral issues (NW, 28 October 1993: 10-12; NW, 17 March 1994: 16-17).

8.2 International Negotiations on a Closure Deal

In response to Kiev's plans to resuscitate the ill-fated Chernobyl plant, the IAEA carried out in March 1994 a two-week safety review mission at the Chernobyl NPP. The mission found a number of serious safety deficiencies and in an unusually alarming tone for the IAEA concluded that "international levels of safety were not being met" at the Ukrainian plant (NW, 7 April 1994: 1). The IAEA team also confirmed that the so-called sarcophagus—i.e. the shelter covering the destroyed fourth unit of the plant—was in a state of "accelerated deterioration" and represented an additional safety problem. The disturbing conclusions of the safety review mission prompted the IAEA to hold an emergency conference in late April 1994

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[4] Outstanding bilateral issues between Ukraine and Russia included the withdrawal of former Soviet nuclear weapons, the division of the Black Sea Fleet, the status of Sevastopol, the ownership of former Soviet assets, and various territorial disputes, especially over Crimea (Ebel 1997: 272).

[5] In February 1993, Russian officials proposed that Ukraine give up its share of the Soviet Union's assets abroad in exchange for its energy debt. Moreover, at a September 1993 meeting in Massandra convened to resolve the dispute over the division of the Black Sea Fleet, Russian officials suggested that Ukraine trade its share of the fleet in exchange for gas debt relief (Markus 1995: 16).

to explore possible solutions both to the critical safety situation at the Chernobyl plant and to Ukraine's energy dilemma (NW, 14 April 1994: 1, 10).

Yet the IAEA emergency conference proved to be a failure: The Ukrainian delegation, led by Vice Prime Minister Shmarov and the chairman of the State Committee for Atomic Energy (Goskomatom), Mikhail Umanets, used the occasion to emphasize the central role of nuclear power for Ukraine's energy needs and stunned Western officials with the blunt assertion that there was no prospect of the two operational reactors at the Chernobyl NPP being closed any time soon (EEE Report, May 1994: 7). Shmarov also indicated that the plant's closure would cost around $4 billion: $1 billion to construct a second sarcophagus over the ruined fourth unit, $1.2 billion to complete various nuclear reactors under construction, $1 billion to decommission the plant, and $800 million to upgrade existing thermal generating capacity. In short, the IAEA emergency conference did not only end without any decision on what to do, but also left many Western officials wondering whether the Ukrainian delegation's blunt assertion that the Chernobyl NPP would remain in operation had been a gambit to attract Western financial support for the country's ailing power sector (NW, 28 April 1994: 11).

Ever since early 1994 the European Commission, acknowledging that Ukraine's reluctance to prematurely close the Chernobyl NPP was at least partly determined by the country's critical energy situation, had been contemplating the idea of funding the completion of two to three partly built Ukrainian VVER-1000 reactors to facilitate the early closure of the troubled plant. This option was strongly backed by the governments of France and Germany whose domestic nuclear industries stood to benefit considerably from the completion work. On 16 May 1994 foreign ministers of the EU agreed in principle to help Ukraine close the Chernobyl NPP. However, EU Member States differed on the specific objectives of a closure package, with the United Kingdom and other EU Member States arguing against the completion of partly built nuclear reactors, as proposed and endorsed by the European Commission, France and Germany (NW, 19 May 1994: 14).

In the following weeks, the French and German governments worked hard to garner support for a Chernobyl closure "action plan", encompassing both an overhaul of the Ukrainian energy sector and the completion of existing nuclear reactors. By the end of June 1994, their combined efforts had materialized: At their summit meeting in Corfu on 24-25 June 1994, EU Member States agreed to allocate ECU 100 million (then about $120 million) in grants over three years from the Union's TACIS program to help Ukraine develop energy

sector programs and pledged to raise ECU 400 million in Euratom loans to help fund the completion of three unfinished VVER-1000 units in Ukraine (Zaporozhe-6, Khmelnitsky-2, and Rovno-4). The EU made its financial assistance conditional upon Kiev closing the Chernobyl NPP as soon as possible, initiating structural reforms of the country's energy sector, strengthening nuclear operation standards and signing the Vienna Convention. The amount of assistance pledged by the EU at the Corfu summit meeting was of course far from sufficient. Indeed, the European Commission had estimated that the total costs of closing the Chernobyl NPP would amount to ECU 1.8 billion (then about $2.16 billion). Commission officials indicated that EU assistance could be increased only through "detailed discussions with Ukraine on an action plan", including the establishment of a firm schedule for meeting commitments (NW, 30 June 1994: 9). Furthermore, the EU was counting on the non-European members of the G-7, in particular the United States, to endorse its action plan and pledge additional financial assistance at the upcoming G-7 summit meeting in Naples (IHT, 2 July 1994).

The Naples G-7 summit on 8-10 July 1994 proved to be a veritable disappointment for those countries expecting the provision of a large Western aid package. Indeed, although the G-7 countries formally endorsed the EU's action plan—the G-7 countries reportedly agreed to seek the closure of Chernobyl units 1 and 3 by 1996 and 1997 (NW, 10 November 1994: 14)—they approved only $200 million in grants, bringing up the total amount of committed Western assistance to $800 million. The G-7 also pledged to call upon IFIs, such as the World Bank, the EBRD and the EIB, to provide additional funds, but indicated that such money would be conditional upon far-reaching reforms in the Ukrainian energy sector (EEE Report, 27 July 1994: 1). The rather disappointing amount of aid pledged at the G-7 Naples summit meeting can be traced back to a number of problems. To begin with, there was considerable disagreement among the G-7 countries about the preferred approach to compensate Ukraine for the power foregone by the closure of the Chernobyl NPP. Indeed, whereas the French and German governments—looking out for the commercial interests of their nuclear industries—were pushing hard for the completion of Ukrainian VVER-1000 units, other G-7 countries were initially less enthusiastic about this approach and favored the implementation of demand management programs and the rehabilitation of existing hydroelectric and thermal power plants (NW, 16 June 1994: 6-7). In fact, the U.S. government was at the time evenly split on the issue over how best to offset the shortfall in Ukrainian electricity supply following the closure of the Chernobyl plant. While the State Department was in favor of funding the partly

built nuclear reactors, the Department of Energy (DoE) urged the U.S. and other Western governments to help Ukraine become more energy-efficient and develop alternative sources of power (NW, 16 June 1994: 7; NYT, 14 June 1994).

Another key problem at the G-7's Naples summit was working out how much it would cost to improve nuclear safety in Ukraine (EEE Report, July 1994: 2). Alone the estimated costs for the completion of the three unfinished VVER units varied considerably: While the European Commission had put the cost between $900 million and $1.2 billion, the EBRD had suggested that $1.5 billion would be necessary. In any case, estimates of the G-7 nuclear safety working group (NSWG) and the EU on the total costs of closing the Chernobyl NPP—ranging between $2 and $3 billion—were substantially below the estimates of Ukrainian officials. Moreover, Western countries had become increasingly aware that Ukrainian officials had been deliberately manipulating Western concerns about the safety of the Chernobyl NPP and playing an increasingly ambitious stalling game in an effort to wring as much money out of the West as possible in exchange for the plant's closure (EEE Report, June 1994: 4). Ukraine's upping of the ante confirmed such suspicions: While Vice Prime Minister Shmarov had spoken of $4 billion at the IAEA's emergency conference in late April 1994, a few weeks later he insisted that the closure of the plant by 2004 would cost between $6 and $8 billion (NW, 19 May 1994: 14). Goskomatom chairman Umanets and the manager of the Chernobyl NPP, Sergei Parashin, pronounced similar figures. Ukrainian President Kravchuk had raised the stakes even higher by announcing in late May 1994 that closing the Chernobyl NPP would entail costs in the order of $14 billion (NW, 16 June 1994: 6). Finally, the fear of creating a costly precedent for ongoing international efforts to shut down other RBMK reactors operating in the Russian Federation and Lithuania may have contributed to the Western countries' reluctance to commit a comprehensive aid package for the closure of just two operational RBMK units in Ukraine (FAZ, 8 July 1994).

During the following months the fate of the Chernobyl NPP remained in limbo. Dismissing the Western action plan on the grounds that the amount of aid pledged by the EU and the G-7 was far from inadequate to justify the closure of a plant that allegedly still had an important energy potential, provided 5'000 jobs and indirectly supported some 23'000 people, various Ukrainian officials subsequently called for the long-term operation of the troubled facility (NW, 21 July 1994: 8; EEE Report, August 1994: 19). Further impeding the negotiation process was the fact that the incoming Ukrainian government under the newly elected President Leonid Kuchma had not yet formulated an official position on Chernobyl.

By the fall of 1994 the EU had grown so incensed about the ongoing failure of Kiev to commit to a closure schedule that it suspended an already approved ECU 85 million balance of payment loan to Ukraine (Lapychak 1995: 21). Most likely as a result of this economic pressure, the Ukrainian government returned to the negotiating table, but continued to hold out for more money and to insist on far-reaching conditions. At a meeting with U.S. President Clinton in November 1994, Ukrainian President Kuchma suggested that the West provide up to $4.5 billion for the early closure of the plant. This figure included $1.5 billion to decommission Chernobyl and to complete three unfinished nuclear reactors, and $3 billion to build two new nuclear reactors near Slavutich, a new demand that reflected Kiev's concerns about the social consequences of closing the plant. Moreover, Kuchma insisted that Chernobyl closure would only be initiated after the new nuclear reactors had been completed and that in any case repair work on unit 2 would continue in the interim (Ebel 1997: 309). In an effort to narrow the options and estimates on both sides and to flesh out a detailed action plan, the G-7 established a special task force in late 1994, comprising energy experts from the G-7, the World Bank, the EBRD, the IEA, and the Ukrainian government. Nevertheless, negotiations once again came close to break-down since the Ukrainian negotiators proved unwilling to agree on any near-term closure date and continued to insist on receiving funds for the construction of a new nuclear power plant near Slavutich, although the G-7 had previously rejected this option (NW, 5 January 1995: 13-14).[6]

The deadlock in the negotiations was finally broken during the visit of a high-level political delegation of the EU to Kiev in mid-April 1995. On 13 April 1995 President Kuchma agreed in principle to close the Chernobyl NPP by 2000, thereby providing for the first Ukrainian closure commitment. The breakthrough in negotiations can be largely attributed to the fact that the Ukrainian government had realized that non-cooperation on the Chernobyl closure issue would hold up the release of much needed Western financial and economic aid. Indeed, in March 1995 the EU had promised to release the suspended ECU 85 million balance of payment loan if Kiev agreed to prematurely close the Chernobyl NPP and hinted that a closure commitment could pave the way for more economic aid (NW, 20 April 1995: 13). A further reason for the breakthrough in negotiations on the Chernobyl closure issue was that Western officials had become increasingly aware of the need to negotiate directly with

[6] The Ukrainian government had also become rather wary about the credibility of Western aid commitments, arguing that Ukraine had so far received nothing but promises from the West in exchange for its willingness to transfer Soviet nuclear weapons to Russia (NW, 23 March 1995: 16).

Ukrainian President Kuchma. Progress had stalled during the past months not least because the Ukrainian government had so far been represented in negotiations by Goskomatom, the state organization responsible for operating the Ukrainian NPPs, which by nature had a vested interest in keeping the Chernobyl NPP in operation (NW, 30 March 1995: 7).

On 16-17 May 1995, representatives of the G-7 convened with Ukrainian officials in Kiev to confirm a schedule for closing the Chernobyl NPP by 2000. The timetable submitted by the Ukrainian government called for the closure of unit 1 in 1997, the decommissioning of unit 2 (not operational since 1991) in 1996, and the closure of unit 3 in 1999 (NW, 1 June 1995: 7-8). Ukrainian experts had estimated that it would cost $4.5 billion to close the plant, and Kiev made it clear that implementation of the closure schedule was conditional upon the West footing the bill (NEI, June 1995: 6). The amount of assistance demanded by Ukraine did not only comprise the direct costs of closing the Chernobyl NPP, i.e. the costs of decommissioning the plant and constructing waste and fuel storage facilities. It also included international funding for the reconstruction of the ailing sarcophagus, the resettlement of the plant's workforce, decontamination of the surrounding zone and—most important—the construction of replacement power generating capacity. Interesting enough, by proposing Western funding to build a new 3'000 MW gas-fired combined-cycle power plant near Slavutich, Ukraine had demanded for the first time in negotiations with the West a non-nuclear alternative to replace the Chernobyl NPP (NW, 20 April 1996: 13-14).

President Kuchma's agreement in principle to close the Chernobyl NPP by 2000 was greeted with applause in the West and did not go unrewarded: On 1 June 1995, the EU signed an interim trade agreement with Ukraine which triggered the immediate release of the frozen ECU 85 million balance of payments loan. Furthermore, the EU agreed to provide additional economic assistance in the order of ECU 200 million (then about $240 million) provided that Kiev stuck to its closure commitment (NN, July 1995: 31; Economist, 22 July 1995: 18). Kiev's April 1995 closure commitment also unleashed a fierce commercial battle among Western European engineering firms over how to replace the generating capacity of the Chernobyl NPP. A consortium of 12 Western companies led by the Swiss-Swedish engineering firm ABB was the first to act and proposed to build a 3'000 MW gas power plant near Slavutich for around $2-3 billion. On 27 May 1995 the Ukrainian government expressed its tentative approval of the gas plant option by signing a memorandum of understanding with ABB (NZZ, 29 May 1995). A consortium led by Germany's Siemens subsequently criticized ABB's proposal on the grounds that a gas-fired power plant would only aggravate Ukraine's

balance of payments problems. Instead, Siemens proposed to create 2'000 MW of generating capacity in Ukraine by renovating and modernizing existing coal-fired power plants at a cost of $1.5 billion. Meanwhile, the European Commission—heavily lobbied by the Western European nuclear industry—continued to press for the completion of two to three unfinished VVER-1000 units (NW, 1 June 1995: 6-7).

After the G-7 countries at their summit meeting in Halifax in June 1995 had failed to agree on any concrete replacement options and to commit the billions of dollars requested by Ukraine, it was only in late September when progress was made on the issue. At a meeting in Kiev on 26-27 September, representatives of the G-7 formally rejected the Ukrainian government's proposal to replace the Chernobyl NPP with a gas-fired combined-cycle power plant on the grounds that this would increase the country's reliance on Russian fuel deliveries and exacerbate its foreign debt. They argued that priority should be given to reconstructing the country's hydroelectric facilities, modernizing thermal power plants, especially those using domestic coal, and completing two unfinished VVERs, i.e. the Khmelnitsky-2 and Rovno-4 reactors.[7] G-7 representatives further addressed one of the main reasons for Ukraine insisting on a new power plant near Slavutich—to remedy the social consequences of Chernobyl closure—by proposing to create an international research and technology center on the problems of nuclear and radiation disasters in the Chernobyl zone, a proposal that promised to provide employment opportunities for the laid off Chernobyl-staff and thus help secure the social infrastructure of Slavutich. Finally, for the first time, proposed conversion work on the sarcophagus was included in the overall action plan. On the financial level, the G-7 indicated its willingness to allocate $1.2 billion for the rehabilitation of the Ukrainian energy sector, about $200 million for shutting down the Chernobyl units, a little more than $4 million for preliminary work on the sarcophagus, and about $3 million for the creation of the international research and technology center (NW, 12 October 1995: 9; NucNet, 29 September 1995).

Although the Ukrainian leadership supported the proposed measures contained in the West's action plan, it was far from content with the amount of assistance—roughly $1.4 billion—offered by the Western countries. Ukrainian officials responded by exaggerating the economic value of the Chernobyl NPP and hinting that the closure of the plant may be

postponed.[8] After such measures had failed to galvanize the West into providing the demanded $4 billion, Kiev scaled back on its compensation demands in mid-October and put the price tag at $3.2 billion (NW, 26 October 1995: 12-13). During talks in early November, the G-7 increased its aid package to $2.2 billion, but insisted that Ukraine contribute at least $900 million towards the closure costs. Not willing to agree to such a formula, Ukrainian Prime Minister Marchuk warned that the Chernobyl NPP would be upgraded for continued operation if agreement on the amount of Western assistance were not reached by the end of the year (NucNet, 30 November 1995; NW, 14 December 1995: 13).

Frustrated with the lack of progress in reaching an agreement, several Western countries increased the pressure on the Ukrainian government in subsequent weeks by threatening to withhold desperately needed credits until Kiev compromised (NW, 11 January 1996: 1, 8; Marples 1996a: 30). Responding to this pressure, President Kuchma, who was said to be personally in favor of shutting down the plant, sacked Goskomatom chairman Umanets in late November. Umanets was an influential exponent of the Ukrainian nuclear industry and had along with the management of the Chernobyl NPP endorsed plans to keep the troubled facility in operation until the end of its service life. G-7 representatives had hence regarded Umanets as a major obstacle to reaching a closure agreement (NEI, October 1995: 12; NW, 14 December 1995: 13). These developments cleared the way for concluding on 1 December a draft agreement on the principles of a comprehensive Chernobyl closure deal. Less than three weeks later, on 20 December 1995, representatives of the G-7, the European Commission, and the Ukrainian government met in Ottawa, Canada, to sign the Memorandum of Understanding on the closure of the Chernobyl NPP.

The December 1995 Memorandum of Understanding (MoU) between the G-7, the European Commission and Ukraine was based on Ukrainian President Kuchma's April 1995 pledge to close the Chernobyl NPP by the year 2000 and incorporated the G-7's commitment to support Chernobyl's closure and the development of "long-term, sustainable, market-oriented energy", including the completion of the two partly built VVER-1000 units Khmelnitsky-2 and Rovno-4. The MoU foresaw the provision of $498 million in grants and

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[7] Originally, the EU and the G-7 had envisaged completing three partly built VVER-1000 units to compensate Ukraine for the closure of Chernobyl units 1-3. However, Ukraine had completed the partly built Zaporozhe-6 reactor with its own funds and connected the new reactor to the grid in October 1995 (NW, 19 October 1995: 6).

$1.809 billion in international and Euratom loans at preferential rates, a large part of which related to projected investments by IFIs and was pending approval based on least-cost and feasibility studies. The MoU defined four separate areas of action: a) energy sector reform, b) least-cost power supply and efficiency investments to meet national power demand, c) nuclear safety issues associated with Chernobyl's decommissioning, and d) the social impact of closing the Chernobyl NPP. Activities in each area were divided into unprofitable and profitable projects, the former being financed by grants, the latter by loans. Priority projects identified as unprofitable and thus to be funded by grants included power sector restructuring ($43 million), energy investments ($102 million), safety improvements at Chernobyl unit 3 and a 15-year decommissioning plan ($349 million), transformation of the sarcophagus into a safe structure (undetermined), and a social impact plan ($4 million). Projects considered in the MoU to generate revenue included the completion of the Khmelnitsky-2 and Rovno-4 reactors along with the construction of high-voltage transmission lines, the reconstruction of hydroelectric and thermal power plants, and the promotion of energy efficiency and demand-side management measures (NW, 11 January 1996: 9; MoU, December 1995).

8.3 Implementation of the MoU

The Western donors soon had to acknowledge that the conclusion of the MoU was only a first step towards securing the closure of the Chernobyl NPP and that the haggling over the size and composition of the Western funds was far from over as domestic opposition to the plant's closure began to grow in Ukraine. In February 1996, a significant part of the Ukrainian parliament signaled its disapproval of the closure deal by sending an open letter to President Kuchma stating that there were no economic grounds for prematurely closing the Chernobyl NPP and that the plant should continue to operate until 2007, not least in order to avoid unemployment and social problems among the station's workforce (NEI, April 1996: 7; NW, 2 May 1996: 2). Furthermore, various members of the Ukrainian parliament began to voice increasingly strong criticisms of the amount of pledged aid and the slow disbursement of Western funds. In addition, a number of Ukrainian deputies demanded a larger portion of aid in the form of grants, a demand that reflected the parliament's concern that the Western loans

[8] For example, Ukrainian officials argued that the Chernobyl plant was the most reliable Ukrainian NPP, generating annual profits worth over $1.5 billion—a claim that was highly unrealistic due to the chronic non-payment of bills by Ukrainian electricity consumers (Ebel 1997: 306; NW, 23 March 1995: 16).

for power replacement capacity would further aggravate the country's foreign debt burden (NW, 11 January 1996: 9).

Negotiations between Ukraine and the Western donors took a promising turn at the so-called nuclear safety meeting of the G-7 and Russia in Moscow on 19-20 April 1996. Following the summit's final statements, President Kuchma announced that Chernobyl unit 1 would be permanently shut down by the end of the year, contrary to earlier plans which foresaw operation of the unit at least until 1997 (NW, 2 May 1996: 2). This decision, however, was not free of charge: It had been taken only after Kiev had received assurances from the G-7 that IFIs would earmark a total $3.1 billion—i.e. an increase of roughly $800 million over previous commitments—in exchange for the plant's closure, with the first installments expected before the end of the year. Moreover, the G-7 also agreed to fund reconstruction work on the ailing sarcophagus, with implementation following the completion of a feasibility study (EEE Report, May 1996: 20; NEI, June 1996: 6). The commitment by the G-7 to fund reconstruction work on the sarcophagus certainly helped to assuage Kiev's concerns about creating a situation in which the Chernobyl NPP was shut down and the West lost all interest in the solution of this long-term problem that posed a clear and immediate threat to Ukraine.[9]

Despite these promising steps forward, implementation of the MoU continued to stall. Irritated by the slow disbursement of Western assistance, chief Ukrainian negotiator Yuriy Kostenko warned in mid-October 1996 that the Ukrainian government may reconsider its pledge to close Chernobyl unit 1 by the end of the year (OMRI, 16 October 1996). In the following weeks the Western donors stepped up their efforts to approve funding for various projects foreseen by the MoU. During the final months of 1996, various IFIs and bilateral donors agreed to approve loans for the first conventional energy projects following the conclusion of the MoU.[10] Furthermore, on 12 November representatives of the EBRD and the Ukrainian government concluded an ECU 118 million (then about $142 million) NSA grant agreement and shortly thereafter, on 30 November 1996, the Ukrainian authorities ordered the closure of Chernobyl unit 1 (NW, 5 December 1996: 14). A large part of the NSA grant

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[9] There was widespread concern in Ukraine that the shelter could collapse due to seismic events, extreme weather conditions or continued degradation of the structure of unit 4, and hence give rise to a dispersion of radioactive dust. Moreover, experts feared that the continued ingress of rainwater into the shelter could lead to a contamination of groundwater in the Dnipro basin or possibly trigger a criticality excursion in the remaining fuel-containing materials (NEI, October 1997: 10).

package was earmarked for two major decommissioning projects—an interim spent fuel facility and a facility for treating the plant's backlog of liquid radioactive waste—and ECU 13.5 million was slated for near-term safety improvements at Chernobyl unit 3 (NW, 28 November 1996: 11-12). Whereas the EBRD argued that the NSA grant agreement represented a "concrete step" towards the closure of the plant according to the timetable set out in the December 1995 MoU, the Ukrainian government warned that the closure of the remaining operational third unit of the Chernobyl NPP by the year 2000 would not be possible if the two planned units at the Khmelnitsky and Rovno NPPs were not commissioned by the same date. Moreover, Ukrainian officials indicated that the second unit of the Chernobyl NPP would be restarted unless the disbursement of Western assistance was speeded up (NucNet, 13 November 1996; OMRI, 15 November 1996).

From late 1996 onward, negotiations between the Western donors and Ukraine on the closure of the Chernobyl NPP centered on two issues: The reconstruction of the ailing sarcophagus over the destroyed fourth unit of the Chernobyl NPP and the proposed completion of the two partly built nuclear reactors at the Khmelnitsky and Rovno NPPs. Progress on the sarcophagus issue had stalled so far partly because the negotiating parties had failed to agree on any of the many proposed solutions—these ranged from a Russian scheme to convert the sarcophagus into a solid concrete monolith to a proposal by a Western consortium to build a new shelter over both Chernobyl units 3 and 4. To determine which solution was the most cost-effective, the European Commission had commissioned a new feasibility study in early 1996. The study's report was finally published in November 1996. It concluded that there was no clear preference among the evaluated options and proposed a stepwise approach. After the G-7 countries had adopted the recommendations of the feasibility study in December 1996, representatives of the G-7 and the Ukrainian government met in Washington in February 1997 and agreed on plans to stabilize the existing structure, thereby definitively shelving the idea of building a second shelter. At a meeting in Slavutich on 22 April 1997, the G-7 and the Ukrainian government approved the so-called "Shelter Implementation Plan" (SIP). The overall objective of the SIP is to render the sarcophagus environmentally safe for a period of about 50 years, during which the means for the ultimate removal and disposal of the destroyed reactor and radioactive debris within the structure can

[10] See Appendix for an overview of the conventional energy projects in Ukraine approved by IFIs and bilateral donors between 1995 and 2000.

be devised.[11] The reconstruction of the shelter was expected to take at least 8-9 years at an estimated cost of around $760 million. Defined as a non-revenue generating project, the SIP would be financed by grants (Nuclear Energy Institute 1997: 208-211; NEI, October 1997: 11).

At their Denver summit meeting in June 1997, G-7 leaders agreed to contribute $300 million towards implementation of the SIP and endorsed the establishment of a new multilateral funding mechanism to be administered by the EBRD—the so-called "Chernobyl Shelter Fund". Furthermore, the G-7 announced that it would hold a special pledging conference before the end of the year with the aim of meeting the balance of the required $760 million (NEI, July 1997: 2). However, this goal proved to be too ambitious: At the Chernobyl Sarcophagus Pledging Conference held on 20 November 1997 in New York, thirteen countries, including the EU, announced new funding pledges in the order of $37 million and Ukraine agreed to contribute $50 million in-kind for the project. In addition, a number of countries made statements of support for the sarcophagus initiative, and the G-7 promised to continue to solicit international and private sector support for the reconstruction project. Despite the apparent shortfall in funding, the Ukrainian government subsequently announced that the firmly pledged $387 million—roughly over half of the estimated project costs—was enough to start implementation of the SIP (NEI, December 1997: 2; NEI, January 1998: 8; EEE Report, December 1997: 1-2). By mid-1998 the EBRD had awarded the first contracts for a project management unit and for licensing assistance and had allocated ECU 103 million for a number of priority projects that were slated for implementation over a two year period (NW, 14 May 1998: 15; NW, 24 September 1998: 15-16; EBRD 2000: 9).

These promising steps forward on the sarcophagus issue were clouded by the protracted negotiations over Western funding for the proposed completion of the Khmelnitsky-2 and Rovno-4 reactors, the so-called K2/R4 project. In early 1996 the G-7, which as a body has no direct fund raising ability, had instructed the EBRD to assume a leading role in financing the completion of the two partly built VVER-1000 units. The

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[11] The SIP consists of 22 primary tasks and 297 constituent activities within five major areas: 1) reducing the probability of sarcophagus collapse, 2) reducing the consequences of an accidental collapse, 3) increasing nuclear safety, 4) improving worker and environmental safety, and 5) developing a long-term strategy and study for conversion of the sarcophagus to an environmentally safe site (Nuclear Energy Institute 1997: 210). The SIP is not an explicitly technical solution to the problem but a logical approach to finding the optimal route through the various technical scenarios previously studied. As such the SIP is "decision-based", involving the evaluation of data and technical studies undertaken as the project evolves (NEI, October 1997: 11).

Western project sponsors had envisaged that the EBRD would provide around $375 million, i.e. roughly a third of the then estimated $1.2 billion project costs. The EU had already pledged a Euratom loan of ECU 400 million (then about $480 million), and the remaining funds were expected to be provided by various Western import-export banks and Ukraine. In September 1996 the EBRD appointed an independent panel of experts under the chairmanship of British professor John Surrey to assess whether the completion of the K2/R4 project was the least-cost option for meeting Ukraine's electricity demands following the anticipated closure of the Chernobyl NPP. The EBRD's decision to appoint an independent panel to assess the cost-effectiveness of the nuclear completion project was certainly consistent with the bank's energy operations policy that carries stringent requirements on the use of bank loans for energy projects. On the other hand, this decision probably reflected the bank's desire to avoid a repeat of its frustrating experiences with the abortive Mochovce completion project in the Slovak Republic. Indeed, in October 1995 the German consulting company Lahmeyer International had already completed a least-cost study for the EBRD. This study had concluded that completing the two unfinished VVER-1000 units was the overall least-cost investment option and it was on the basis of this assessment that the K2/R4 project had been included in the December 1995 MoU as the principal Chernobyl power replacement project. However, various environmental groups and independent energy experts had subsequently criticized Laymeyer's least-cost study as being biased and inaccurate. It is hence likely that the EBRD appointed the independent panel in an attempt to avoid getting in the firing line again (NW, 19 September 1996: 1; Energy Economist, July 1998: 7-14; Surrey and Thomas 1999: 326).[12]

Five months later, in February 1997, the EBRD published the final report of the independent panel, whose conclusions were devastating for the K2/R4 project: All but one of the panel members concluded that the plan to complete the Khmelnitsky-2 and Rovno-4 reactors would not be the most cost-effective use of $1 billion or more of Western funds at this time. The independent panel argued that economic activity and electricity demand had fallen so sharply in the past few years that Ukraine currently enjoyed a large surplus of power generating capacity, and predicted that even with sustained economic recovery Ukraine would

[12] The fact that the independent panel did not include any French members also points to the EBRD's desire to avoid a second nuclear debacle: In 1995, the EBRD's French President de Larosière had been severely criticized for loading the Mochovce project office with French nationals in what critics saw as a French attempt to take-over the project and promote the commercial interests of the French nuclear industry. Since EdF and Framatome stood to benefit from a Western-sponsored completion of the K2/R4 project, the EBRD deliberately appointed no French national to the panel (NW, 19 September 1996: 9; see also Case Study III).

not require additional generating capacity until 2010. The panel also argued that there was a more pressing need to implement safety upgrades at the country's existing 11 VVER-1000 nuclear reactors than to complete the Khmelnitsky-2 and Rovno-4 reactors. Indeed, if the implementation of safety upgrades increased operational reliability as well as nuclear safety, the extra output of the existing nuclear reactors would make the completion of the K2/R4 project even less worthwhile. Finally, the panel felt that the vast potential for energy efficiency in Ukraine had not been sufficiently explored. As such the panel concluded that the least-cost approach to Ukraine's energy problems was to enhance the operational reliability and efficiency of the country's existing nuclear, thermal and hydroelectric power plants, to rehabilitate the deteriorating and highly inefficient transmission and distribution grid and to reduce excess demand by promoting energy efficiency schemes among industrial and residential energy consumers. As a matter of fact, the independent panel warned that the proposed K2/R4 project could possibly exacerbate Ukraine's energy problems. Indeed, the installation of additional generating capacity threatened to use up the country's scarce borrowing capacity for a purpose not needed and to undermine the efficiency objectives behind the Ukrainian government's proposed market-based reforms throughout the energy sector (Surrey et al. 1997; Surrey 1997: 871-875).

The independent panel's report dealt a serious blow to the implementation of the December 1995 MoU that had designated the completion of the Khmelnitsky-2 and Rovno-4 reactors as the principal Chernobyl power replacement project. The panel's conclusion that the K2/R4 project was not the least-cost option for Ukraine's energy needs implied that the EBRD could not fund the nuclear completion project. Yet the future of the K2/R4 project hinged on the approval of loans by the EBRD since the Euratom loan facility—the only other identified international source of finance for the project—was authorized to finance not more than 50 percent of the costs of any project it participated in and had announced that it would follow the EBRD's lead (NW, 2 January 1997: 13-14). On the other hand, there was a growing perception in the West that Ukraine would soon close the Chernobyl NPP irrespective of whether or not the Western donors agreed to fund the K2/R4 project. Western officials had become increasingly aware that the restart of Chernobyl unit 2 was becoming more and more unlikely since Ukraine lacked the necessary funds and technical expertise to

refurbish the ailing reactor.[13] Moreover, Chernobyl unit 3, the remaining operational reactor at the plant, had been shut down in July 1997 for a scheduled maintenance outage. During the maintenance outage, which was originally expected to last for about three months, 263 new cracks and defects in the unit's coolant pipes were discovered which in turn meant that the unit's repair would be seriously extended and the costs of restarting the reactor considerably increased. As a result various members of the Ukrainian nuclear community predicted that Chernobyl unit 3 would not be reconnected to the grid if the repair money were delayed (NN, September 1997: 26-27; NW, 6 November 1997: 2-3).

Despite these developments, the fate of the K2/R4 project was far from sealed and the haggling over the required funds continued. Determined to avert the growing perception in the West that the Chernobyl problem might go away on its own and eager to preserve its remaining bargaining chip in negotiations with the Western donors, the Ukrainian government undertook strenuous efforts to mobilize the needed funds—estimated at around $55 million—to repair the debilitated third unit of the Chernobyl NPP (NN, December 1997: 38, 59). In mid-May 1998, shortly after the EBRD had held its annual board meeting in Kiev, the Ukrainian authorities brought Chernobyl unit 3 back on line.[14] Furthermore, between November 1997 and May 1998 various Ukrainian officials and government agencies repeatedly warned that the Chernobyl NPP would not be closed by 2000 unless the Khmelnitsky-2 and Rovno-4 reactors were completed by that time and even threatened to begin with preparations to upgrade Chernobyl units 2 and 3 for extended operation until 2010-2015.[15]

Finally, the Ukrainian government began to discuss with Russian officials the possibility of completing the Khmelnitsky-2 and Rovno-4 reactors in collaboration with Russian nuclear engineering firms and with Russian financial assistance. Ukrainian officials were not only frustrated with the apparent reluctance of the EBRD to approve the required loans, but also objected to the high costs of the Western-led project. While Ukrainian officials

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[13] The Ukrainian parliament's proposal to appropriate the necessary financial resources for the refurbishment of Chernobyl unit 2—estimated to cost about $200 million—from the national privatization fund failed to impress Western officials since it was apparent that due to Ukraine's slow privatization process, there was virtually no money in that fund (NW, 24 April 1997: 15-16; NW, 31 July 1997: 5-6).

[14] The Ukrainian authorities had originally planned to bring Chernobyl unit 3 back on line on 5 May, i.e. three days before the opening of the EBRD's annual meeting in Kiev, but agreed to comply with a request by the EBRD to postpone the unit's startup (RFE/RL Newsline, 28 April 1998).

[15] For official pronouncements along these lines, see RFE/RL Newsline, 18 November 1997, 12 February 1998, 6 May 1998, 12 May 1998; NW, 9 April 1998: 1; NW, 7 May 1998: 11.

argued that the two nuclear reactors could be completed at a cost of no more than $800 million, the EBRD estimated the total project costs at over $1.2 billion, not least because the Western-led project included the installation of additional nuclear safety measures. Following a series of bilateral talks in late 1997 and early 1998, the Russian government agreed in February 1998 to grant Ukraine a technical loan in the order of $180 million towards joint completion of the K2/R4 project (EEE Report, February 1998: 35; RFE/RL Newsline, 23 February 1998). The Ukrainian threat to turn the K2/R4 project over to the Russians was no doubt designed to increase the pressure on the Western donors to allocate the required loans. Indeed, a Russian take-over of the K2/R4 project would not only result in the loss of lucrative contracts for the Western nuclear industry, but also in the adoption of less strict safety standards than envisaged in the Western-led completion project.

In the meantime, various Western donor states exerted strong political pressure on the EBRD with the aim of prompting the bank to find a formula that would allow for its participation in the K2/R4 project. Many Western donor governments argued that the political imperative to close the Chernobyl NPP remained above and beyond economic criteria: The completion of the Khmelnitsky-2 and Rovno-4 reactors had been defined as the principal Chernobyl power replacement project in the December 1995 MoU, and failure to meet this condition could possibly unravel the Chernobyl closure deal. Strategic considerations also contributed to the ongoing support by the major donor governments for the K2/R4 project. Various Western countries, in particular the United States, were eager to reinforce Ukrainian statehood in order to safeguard against the risk of a failing Ukrainian state seeking a political rapprochement with Russia.[16] Completing the Khmelnitsky-2 and Rovno-4 reactors, which promised to reduce Ukraine's dependence on Russian fossil fuel imports, was regarded as one possible means to prevent such an outcome.[17] In addition, the West did not want to appear deserting Kiev at a time when Russia, irritated about NATO's expansion plans, would likely be pressing hard on Ukraine (Economist, 1 March 1997: 18; FAZ, 3 March 1997; NW, 15 May 1997: 11).

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[16] Zbigniew Brzezinksi, a former U.S. National Security adviser, has described the strong strategic interest of the United States in a viable and sovereign Ukraine with the following words: "It cannot be stressed strongly enough that without Ukraine, Russia ceases to be an empire, but with Ukraine suborned and then subordinated, Russia automatically becomes an empire" (FT, 4 May 1998; see also NZZ, 27 May 1998). It is therefore not surprising that Ukraine has become the third largest recipient of U.S. aid after Israel and Egypt (Ebel 1997: 276).

Finally, several donor governments feared that if the West failed to finance the K2/R4 project, Ukraine would still complete the two VVER-1000 units, however no longer to the rather strict safety standards envisaged in the Western-led completion project, but to the original Russian design specifications, and without Western nuclear engineering firms benefiting from the lucrative upgrade and completion work. The latter concern was pronounced in particular among the governments of France, Germany and the United States whose domestic nuclear industries were expected to assume a leading role in implementing the nuclear completion project (EEE Report, May 1997: 1-2; FAZ, 30 July 1997).

At the instigation of various Western donor governments, the EBRD quietly dropped the conclusions of the independent panel and commissioned the American consulting firm Stone & Webster to re-assess the project's cost-effectiveness. This second economic analysis, which was presented to the EBRD in May 1998, concluded that there was a 50 percent probability that the completion of the Khmelnitsky-2 and Rovno-4 reactors constituted the least-cost approach to Ukraine's energy needs.[18]

Although Stone & Webster's conclusions hardly represented a ringing endorsement of the K2/R4 project, they were apparently sufficient—along with ongoing pressure by the major Western donor governments—to induce the EBRD to consider getting involved in the controversial nuclear completion project. In mid-June 1998 the EBRD announced that the K2/R4 project had passed initial review, thereby triggering the launch of a four-month public consultation process before the project would be submitted for final review and then to the bank's board for approval. However, the EBRD remained highly critical of the project's financial viability. To begin with, the bank stated that it would contribute no more than $190 million towards the now estimated $1.7 billion project costs—a financial contribution far below the $375 million the Western project-sponsors had originally envisaged. In addition, the EBRD specified that the Khmelnitsky-2 and Rovno-4 reactors would have to be built

[17] The strategic interest of the G-7 countries in reducing Ukraine's dependence on Russian fossil fuel supplies was expressed in their vetoing of the Ukrainian government's proposal in early 1995 to replace the Chernobyl NPP with a gas-fired combined-cycle power plant (Surrey and Thomas 1999: 331).

[18] With a view to the fact that the assumptions used in Stone & Webster's re-assessment of the K2/R4 project had been largely provided by Ukrainian, EU and U.S. officials, i.e. all interested parties, it was not surprising that the consultant's report was generally optimistic about the project's cost-effectiveness (Energy Economist, July 1998: 10).

sequentially, with loans for the second unit being granted only when the first unit was completed.[19]

Finally, it made the disbursement of any loans for the nuclear completion project contingent upon a host of far-reaching conditions. Concerned that the low level of cash payments for power in Ukraine could result in a non-performing loan and therefore impact on its AAA credit rating, the EBRD insisted that Ukraine make significant progress in reforming its energy sector. Specifically, the bank demanded that the Ukrainian government improve the poor cash-collection rates in the country's power sector, reduce barter-deals and increase electricity tariffs. Moreover, the EBRD added a new condition which went far beyond the December 1995 MoU's emphasis on energy sector reform: By indicating that it would only consider approving loans for the K2/R4 project once the Ukrainian government had signed the $2.2 billion Extended Fund Facility (EFF) then under negotiation with the International Monetary Fund (IMF), the EBRD effectively linked the fate of the nuclear completion project to wider economic reform in Ukraine (NW, 18 June 1998: 20-21; Energy Economist, July 1998: 10, 13).

The stringent loan conditions spelled out by the EBRD did not go down well with the Ukrainian government. Indeed, Kiev feared that the onerous loan conditions imposed by the EBRD would seriously delay the disbursement of Western funds for the nuclear completion project. Consequently, in July 1998 the Ukrainian Cabinet of Ministers issued a statement in which it formally linked the closure schedule of the Chernobyl NPP to the starting up of the Khmelnitsky-2 and Rovno-4 reactors. The Cabinet statement declared quite frankly that this linkage aimed to make the Western donors more responsive to their obligations under the December 1995 MoU and hence to accelerate financing of the K2/R4 project (NW, 6 August 1998: 11).

In the following months progress on the K2/R4 funding issue inched forward. In December 1998 the four-month public consultation process was successfully concluded. Whereas various Western anti-nuclear governments and environmental groups protested vehemently against the EBRD's decision to accept the results of the public consultation process, project proponents were reportedly optimistic that the EBRD would soon approve

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[19] According to the EBRD, the proposal to build the two reactors sequentially reflected "the need to mitigate the very substantial risk that the project will not be completed on time or on budget and that microeconomic discipline and the drive towards structural reforms will not be maintained, endangering the repayment of sovereign loans" (Energy Economist, July 1998: 11-12).

loans for the K2/R4 project, which in turn was expected to trigger the definitive closure of the remaining operational unit at the Chernobyl NPP by the end of 1999 (NW, 17 December 1998: 13, 15). Decision-makers at the European Commission and the EBRD now appeared determined to press on with loan financing, even though the EIB had stated its reservations about the project's financial viability in a January 1999 memorandum (EEE Report, February 1999: 13-14). Indeed, a TACIS briefing issued on 12 April 1999 described the plan to complete the two Ukrainian reactors as "perfectly defined" and "economically justified" and confirmed that the contractors for the project had been selected and approved by the EBRD and Euratom (EEE Report, April 1999: 6-7). Furthermore, in May 1999 the EBRD's Operations Committee formally approved the K2/R4 project, thereby making way for a final board decision on the matter (PEE, 10 June 1999: 12). In the meantime, the Ukrainian authorities had taken important decisions to settle the status of Chernobyl units 1 and 2. In December 1998 the Ukrainian nuclear utility Energoatom had received a license to begin the first phase of decommissioning at Chernobyl unit 1, and in March 1999 the Ukrainian government announced that it had abandoned earlier plans to repair and restart the second unit of the Chernobyl NPP (NW, 17 December 1998: 14; NW, 25 March 1999: 17).

However, the growing momentum in favor of Western financing of the K2/R4 project—and hence the improved prospects of securing the definitive closure of the Chernobyl NPP by the end of 1999—suffered a serious setback in mid-1999 due to a widening fissure among the Western donor governments. Indeed, just days before the G-7 countries were expected to endorse the K2/R4 project at their June 1999 summit meeting in Cologne, which was expected to pave the way for a positive EBRD board decision in July, the Bundestag voted against German participation in the funding of the two nuclear reactors and called on the German government to support non-nuclear alternatives in Ukraine instead (PEE, 10 June 1999: 12-13; EEE Report, June 1999: 19; NW, 24 June 1999: 5-7). Henceforth the new administration under Chancellor Gerhard Schröder, a fragile coalition government between the Social Democratic Party and the anti-nuclear Green Party, signaled its opposition to the nuclear completion project. Given the political weight of Germany within the EBRD and the large amount of export agency credits it had been expected to provide, the German government's sudden change of course added a new uncertainty to the fate of the K2/R4 project and consequently delayed formal discussions at the EBRD.

In early July 1999 the Ukrainian government rejected Gerhard Schröder's proposal to replace the Chernobyl NPP with modern thermal power facilities and subsequently warned

the West that the troubled Chernobyl facility would remain in operation until the Khmelnitsky-2 and Rovno-4 reactors were completed (RFE/RL Newsline, 12 July 1999; NW, 15 July 1999: 6-7; NW, 5 August 1999: 8). Finally, after having been shut down for five months for additional repairs, the third unit of the Chernobyl NPP was reconnected to the grid in late November 1999, just weeks before the Western donors had hoped the plant would be definitively closed according to the December 1995 MoU.[20] The Ukrainian government justified its decision to keep Chernobyl unit 3 in operation until an unspecified date in 2000 on the grounds that Ukraine had not yet received the funds promised by the West to complete the Khmelnitsky-2 and Rovno-4 reactors (PEE, 26 November 1999: 10; RFE/RL Newsline, 29 November 1999). Although the restart of the debilitated third unit of the Chernobyl NPP caused concern amongst the Western donors, they grudgingly accepted the Ukrainian government's plans to keep the unit in operation for some time. However, G-7 representatives warned the Ukrainian government in December 1999 that additional funding for the reconstruction of the sarcophagus would depend on the unit's definitive closure in 2000 (NW, 23 December 1999: 13). Having received contributions in the order of $400 million so far, the SIP was still about $360 million short of the estimated $760 million needed. The Ukrainian government was no doubt hopeful that the outstanding funds for the SIP would be mobilized at a second pledging conference, scheduled to take place in mid-2000.

In subsequent months the Western donors focused their efforts on securing a firm closure date for the remaining operational unit at the Chernobyl NPP. During a visit to Ukraine in early February 2000 U.S. Energy Secretary Bill Richardson promised that the United States would make the largest G-7 contribution to repair the sarcophagus at the upcoming pledging conference and agreed to provide $22.5 million to help complete a thermal power plant to power the Chernobyl site after decommissioning activities had started (NW, 10 February 2000: 5). In the wake of Richardson's visit, Ukrainian President Kuchma ordered his government to set a definitive policy on the plant's future. Although the Ukrainian Ministry of Fuel and Energy continued to lobby for the plant's extended operation, the Ukrainian cabinet decreed on 29 March 2000 to permanently close the Chernobyl NPP in 2000 (NW, 2 March 2000: 12-13; NW, April 2000: 9-10). Two months later, on 5 June, Ukrainian President Kuchma announced after talks with U.S. President Clinton in Kiev that

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[20] Chernobyl unit 3 was reconnected to the grid on 28 November 1999 only to be taken off-line on 3 December for further repairs following the detection of a leak in the plant's emergency core cooling system. The reactor was restarted on 6 December (PEE, 10 December 1999: 14).

the third unit of the Chernobyl NPP would be definitively closed by 15 December 2000. President Clinton rewarded Kuchma's closure commitment with a firm pledge to allocate $78 million for the reconstruction of the sarcophagus and $2 million for safety improvement projects at other Ukrainian NPPs (RFE/RL Newsline, 6 June 2000; NW, 8 June 2000: 12). Kuchma's decision to definitively close the ill-fated plant by the end of the year also led prospective SIP donors to drop their reservations about providing additional funding for the reconstruction of the sarcophagus: At a second pledging conference in Berlin on 5 July 2000, donors agreed to allocate an additional $322 million, thereby securing the continuation of the SIP (NW, 13 July 2000: 15-16).

The commitment by President Kuchma to close the Chernobyl NPP by 15 December 2000 also set a de-facto deadline for the EBRD to take a final decision on the contentious issue of financing the K2/R4 project. During the following months the Western project proponents—eager to prevent the nuclear completion project from falling into the hands of the Russians—worked hard to garner support for a positive board decision at the EBRD (NW, 23 November 2000: 1; RFE/RL Weekday Magazine, 21 November 2000). In the meantime, various factions of the Ukrainian parliament sought to increase the pressure on the Western donors by signaling their intention to pass a bill that would keep the third unit of the Chernobyl NPP in operation past the scheduled closure date if the EBRD failed to approve loans for the project (NW, 9 November 2000: 9; RFE/RL Newsline, 6 November 2000). In mid-November EBRD President Jean Lemierre requested the bank's board of directors to grant Ukraine a $215 million loan towards the completion of the Khmelnitsky-2 and Rovno-4 reactors (NW, 23 November 2000: 1). Three weeks later, and only days before the scheduled closure of the Chernobyl NPP, this funding request was met: On 7 December 2000 the EBRD board approved the $215 million loan by a comfortable margin, not least owing to the decision of Germany to abstain rather than vote against the project.[21]

However, the EBRD board specified that the disbursement of the loan was contingent on a set of strict conditions. Among the board's chief conditions were official confirmation of Chernobyl's permanent closure, resumption by the IMF of its Extended Fund Facility (EFF) to Ukraine, assurances on the safety of the planned K2/R4 reactors and on the independence of Ukraine's nuclear safety authority, and written confirmation by other lending institutions of

[21] Although nine countries represented on the EBRD board voted against the project, their shareholdings in the EBRD were not large enough to overturn approval of a loan. Large EBRD shareholders, such as the United States, Canada, France and the United Kingdom, voted in favor of the project (NW, 14 December 2000: 1).

their expected participation in funding the project.[22] In addition, the EBRD board insisted that the Ukrainian government make progress in reforming the country's energy sector, in particular continued privatization of energy distribution companies and significant increases in both power tariffs and the proportion of cash collection on electricity deliveries (NW, 14 December 2000: 1). Provided that these conditions are met, Ukraine will receive over $1.2 billion in international financing for the completion of the Khmelnitksy-2 and Rovno-4 reactors.[23] Yet irrespective of the final outcome of the K2/R4 project, the Western donors could celebrate one of their biggest successes in the nuclear safety field: On 15 December 2000 the Ukrainian government ordered the definitive closure of the remaining operational unit at the Chernobyl NPP, thereby bringing to an end the seven year struggle between the West and Ukraine over the fate of the world's most infamous nuclear power plant.

8.4 Assessment

To which extent did Ukraine change its externality-generating behavior in a direction desired by the Western donors? In October 1993 the Ukrainian parliament cancelled its previous resolution to close the remaining operational reactors of the ill-fated Chernobyl NPP (units 1 and 3) by the end of 1993 and approved the government's plans to upgrade and extend the service lives of these two units. Moreover, in early 1994 the Ukrainian government approved plans by the Ukrainian nuclear industry to prepare the restart of Chernobyl unit 2 which had been closed in October 1991 due to a fire in the unit's turbine hall. Kiev's decision not to close the Chernobyl NPP as previously scheduled and its plans to grant the troubled facility a new lease on life was greeted with loud dismay in the West. The Chernobyl NPP, equipped with inherently unsafe RBMK nuclear reactors and crippled by the effects of the 1986 disaster, did not only constitute a serious nuclear safety threat, but was also a powerful international symbol of the dangers associated with the exploitation of nuclear power. The leaders of various Western countries therefore insisted that Chernobyl units 1 and 3 be shut down as soon as possible, and that unit 2 not be restarted.

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[22] Shortly after the EBRD board had voted in favor of funding the K2/R4 project, the European Commission approved on 13 December a $585 million Euratom loan towards the completion of the two reactors (NW, 21 December 2000: 13).

[23] According to the international financing plan for the K2/R4 project, the EBRD is to provide $215 million, Euratom $585 million, various Western export credit agencies $348 million and the Russian government $124 million. Ukraine is expected to provide the balance of the estimated $1.48 billion project costs (NW, 14 December 2000: 1).

Despite the urgency of the nuclear safety problem in Ukraine, it took over a year of diplomatic wrangling until the G-7 and EU gained a closure commitment from the Ukrainian government. In April 1995 Ukrainian President Kuchma finally agreed in principle to close the Chernobyl NPP by 2000—but only on the condition that Ukraine receive around $4.5 billion in compensation. After much haggling over the amount of compensation the West would have to pay in exchange for the premature closure of the Chernobyl NPP, the G-7, the European Commission and the Ukrainian government concluded a Memorandum of Understanding (MoU) in December 1995. On the basis of the MoU, the Western donors agreed to provide $2.3 billion in assistance in exchange for the closure of the Chernobyl NPP by 2000. The closure date stipulated in the MoU was rather vague in the sense that it did not clearly specify whether the Chernobyl NPP was expected to be closed before the year 2000 or in 2000. Nevertheless, given the critical safety situation at the Chernobyl NPP, the Western donors no doubt preferred to see the ill-fated plant closed as soon as possible, i.e. anytime before 2000.

Implementation of the December 1995 MoU proved to be a bumpy and protracted process. After the Ukrainian government had agreed to close Chernobyl unit 1 in November 1996, it became increasingly irritated by the slow disbursement of Western assistance, in particular by the apparent reluctance of the Western donors to approve loans for the completion of the Khmelnitsky-2 and Rovno-4 reactors (K2/R4) which had been foreseen by the MoU as the principal Chernobyl power replacement project. As a result, Ukrainian officials repeatedly threatened to restart unit 2 and to postpone the closure of unit 3 if the K2/R4 project was not completed on schedule. To render its latter threat more credible, the Ukrainian government undertook strenuous efforts to keep Chernobyl unit 3 running, despite the fact that the debilitated reactor was in constant need of repairs and clearly unfit for continued operation. Moreover, Kiev also warned the Western donors that if funding for the K2/R4 project was not delivered on time, it would complete the two partly built nuclear reactors at lower cost—and hence at less strict safety standards—with Russian technical and financial assistance. In March 1999 the Ukrainian government finally abandoned its plans to repair and restart Chernobyl unit 2, most likely because it lacked the necessary funds for this complex and costly task, but continued to insist that the closure of unit 3 depended on Western funding for the K2/R4 project. Not least to preserve its remaining bargaining chip in negotiations with the West, the Ukrainian government approved in November 1999 the restart

and continued operation of Chernobyl unit 3 which had previously been shut down for various months for additional repairs.

Nevertheless, the Ukrainian government eventually realized that its threat to upgrade unit 3 for long-term operation was unlikely to entice the Western donors to approve loans for the K2/R4 project and, even more alarming to the cash-strapped country, might jeopardize Western funding for other Chernobyl-related projects, in particular for the reconstruction of the shelter over the destroyed fourth unit of the Chernobyl NPP. As a result, on 5 June 2000 Ukrainian President Kuchma announced that the last operational unit of the Chernobyl NPP would be definitively closed by mid-December 2000. The Chernobyl NPP was duly shut down on 15 December 2000, a couple of days after the EBRD board had voted in favor of funding the K2/R4 project provided that a set of stringent loan conditions was met. In short, Ukraine more or less changed its externality-generating behavior in a direction desired by the Western donors. The Ukrainian government did not only close Chernobyl unit 1 in November 1996, but also abstained from modernizing and restarting unit 2. Moreover, although the Ukrainian government made every effort to keep Chernobyl unit 3 on line as long as possible, which was certainly undesirable from the Western donors' point of view, it ultimately did close the last operational nuclear reactor of the Chernobyl NPP in mid-December 2000.

Which cooperation strategies and what kind of measures were employed by the Western donors to influence Ukraine's behavior? The principal cooperation strategy by which the Western donors sought to enable and induce Ukraine to close the Chernobyl NPP as soon as possible was a *positive incentive strategy*. In June 1994 the EU offered to provide $600 million in grants and loans in exchange for a Ukrainian closure commitment. At their summit meeting in July 1994, the G-7 countries pledged an additional $200 million in assistance for Chernobyl's premature closure. After Ukrainian President Kuchma had finally agreed in principle to close the plant by 2000 under the condition that the West footed the $4.5 billion bill, the Western donors gradually increased their compensation offers. In the December 1995 MoU the Western donors promised to provide $2.3 billion—$500 million in grants and $1.8 billion in loans under favorable conditions—to assist the hard-pressed country with the solution of various Chernobyl-related problems and to compensate Ukraine for the power foregone by the plant's closure. Western grants, which ultimately exceeded the $500 million envisaged by the MoU, were slated for a wide array of measures designed to improve nuclear safety at the Chernobyl NPP, decommission the closed plant, reconstruct the ailing sarcophagus over the destroyed fourth unit (alone for this complex and costly task about $720

million has so far been pledged by various donors), and to mitigate the social consequences of the plant's closure. Moreover, between 1995 and 2000 the World Bank, the EBRD and bilateral donors disbursed or tentatively approved approximately $700 million in favorable loans for the realization of various energy projects aimed at restructuring the Ukrainian power sector, modernizing existing hydroelectric and thermal power plants and enhancing energy efficiency. Finally, after much delay the EBRD announced on 7 December 2000 its tentative approval of a loan for the K2/R4 project. Provided that the Ukrainian government does meet the stringent loan conditions spelled out by the EBRD, Ukraine will receive over $1.2 billion in favorable loans for the nuclear completion project—$215 million from the EBRD, $585 million from Euratom, $348 million from various Western export credit agencies, and $124 million from the Russian government.

Apart from providing a comprehensive package of positive incentives, the Western donors also resorted to *negative incentive strategies* at least twice during the protracted negotiation process. In the fall of 1994 the EU had grown so incensed about the Ukrainian government's apparent reluctance to compromise on the Chernobyl closure issue that it froze an already approved ECU 85 million balance of payments loan, releasing the loan only after Ukrainian President Kuchma had agreed in principle to close the Chernobyl NPP by 2000. Moreover, in late 1995 a number of G-7 countries sought to entice the Ukrainian government to sign the MoU by threatening to withhold an unspecified amount of Western loans. In addition, at one stage of the negotiation process the Western donors also employed a *positive issue-linkage strategy*. In May 1995 the EU linked the disbursement of around ECU 200 million in macro-economic assistance to Ukrainian progress with its Chernobyl closure plan. Finally, the Western donors also employed *cognitive and normative strategies*. By conducting a series of nuclear safety studies and least-cost investment analyses the Western donors sought to furnish the Ukrainian authorities with more reliable information concerning both the risks of keeping the Chernobyl NPP in operation and the costs and benefits of alternative energy strategies. Moreover, during various rounds of negotiations and talks Western government officials and nuclear safety experts sought to persuade the Ukrainian authorities to attach higher priority to nuclear safety issues and hence to abandon their plans to grant the Chernobyl NPP a new lease on life.

To which extent was the observed behavioral change on the part of Ukraine influenced by the provision of positive incentives and how high was the effectiveness of the transaction? Although the Western donors employed various cooperation strategies in parallel to secure the

premature closure of the Chernobyl NPP, it is plausible to suggest that the observed behavioral change on the part of Ukraine was predominantly determined by the provision of positive incentives. From the outset of the negotiation process, the Ukrainian government had made it clear to the G-7 and EU that the closure of the Chernobyl NPP would entail severe political, financial and social costs which the cash-strapped country was both unable and unwilling to bear on its own. Indeed, although the power generated by the Chernobyl NPP accounted for only about 6 percent of the country's total electricity supply, this was still a considerable amount of energy to forego at a time when Ukraine was struggling to cope with a severe energy and economic crisis and when Russia was eager to exploit Ukraine's massive debts for natural gas imports to gain political concessions in other outstanding bilateral issues. In addition, even if ways could be found to replace the power produced by the Chernobyl NPP, Ukraine would still have to cope with a number of costly and complex problems associated with the plant's closure that clearly exceeded its technical and financial capacities. These costly and complex problems included the safe decommissioning of the Chernobyl reactors, the reconstruction of the sarcophagus over the destroyed fourth unit, the resettlement of the plant's workforce, and the decontamination of the surrounding zone.

Against this backdrop, it is rather unlikely that the alternative cooperation strategies employed by the Western donors significantly influenced Ukraine's willingness to prematurely close the Chernobyl NPP. To be sure, the negative incentive strategy employed by the EU in the fall of 1994, i.e. the temporary suspension of an ECU 85 million balance of payments loan, did entice the Ukrainian government to get back to the negotiating table and to agree—at least in principle—to close the Chernobyl NPP by 2000. Similarly, the threat by various G-7 countries in late 1995 to withhold an unspecified amount of Western loans most likely raised the pressure on the Ukrainian government to sign the MoU. And the EU's positive issue-linkage strategy—i.e. its May 1995 offer to provide ECU 200 million in macro-economic assistance provided that Ukraine stuck to its Chernobyl closure plan—may have contributed to the Ukrainian government's willingness to adopt a more cooperative stance during the negotiation process. Nevertheless, since these alternative cooperation strategies did not directly address the key cooperation problem in negotiations with Ukraine—i.e. the latter's insufficient financial and technical capacities to prematurely close the Chernobyl NPP—and were employed only after the Western donors had pledged to provide a significant amount of positive incentives, it is plausible to suggest that their effect on the final outcome of the negotiation process was small. In short, on the basis of these considerations, and with a

view to the fact that Ukraine did comply—after some delay—with the West's closure demands, we can conclude that the *effectiveness* of the transaction was rather high.

How high was the efficiency of the transaction? *First dimension of efficiency*: The transaction was efficient in the sense that it was highly unlikely that an alternative cooperation strategy could have led to comparable or superior behavioral changes on the part of Ukraine at a lower or comparable cost. The Western donors could have sought to increase the incentives on the part of the Ukrainian government to comply with Western closure demands by tying the disbursement of additional economic aid or the improvement of trade relations to the premature closure of the Chernobyl NPP. However, such positive issue-linkage strategies were unlikely to be more cost-effective than positive incentive strategies because they would have not directly addressed the Ukrainian government's key cooperation problem—i.e. the country's critical energy situation and its insufficient financial and technical resources to cope with the costly and complex tasks of closing and decommissioning the Chernobyl NPP. Moreover, it is unlikely that the Western donors would have secured the premature closure of the Chernobyl NPP by resorting to negative incentive strategies. As a matter of fact, it is highly likely that the imposition of economic sanctions or other punitive measures would have only exacerbated Ukraine's destitute economic situation, thereby forcing the hard-pressed country to rely even more heavily on the cheap, but unsafe power produced at the ill-fated Chernobyl NPP. Finally, it is difficult to see how the employment of normative or cognitive strategies could have led to a more favorable outcome from the Western donors' point of view. Indeed, given the strong asymmetric capacities and preferences underlying the nuclear safety problem in Ukraine, it is evident that neither persuasion attempts nor the provision of more complete information concerning the risks of keeping the Chernobyl NPP in operation or the relative benefits and costs of alternative energy strategies would have prompted the Ukrainian government to prematurely close the Chernobyl NPP.

Second dimension of efficiency: Since alternative ways of employing positive incentives could have led to at least a comparable behavioral change on the part of Ukraine at lower cost, the transaction did involve serious inefficiencies. To be sure, the Western donors employed a considerable amount of resources for various cost-effective measures designed to enable Ukraine to prematurely close the Chernobyl NPP, such as for the decommissioning of the plant, the reconstruction of the shelter over the destroyed fourth unit or for the implementation of a number of conventional energy projects aimed at rehabilitating the country's ailing power sector. On the other hand, the Western donors tentatively agreed in

December 2000 to provide over $1.2 billion in loans—a significant part of the total amount of assistance pledged by the West in the December 1995 MoU—to complete the controversial K2/R4 project.

Considering that Ukraine faced a critical energy situation, it is certainly plausible to suggest that the Western offer to help offset the shortfall in Ukraine's electricity supply following the closure of the Chernobyl NPP did entice the Ukrainian government to comply with the West's closure demands. However, it is rather debatable whether the provision of over $1.2 billion in loans for the completion of the two partly built nuclear reactors was the most cost-effective way to enable and induce the Ukrainian government to prematurely close the Chernobyl NPP. Indeed, as the independent panel commissioned by the EBRD had pointed out in its 1997 economic assessment of the K2/R4 project, Ukraine's energy problems did not stem from a lack of power generating capacity (the country actually faced a surplus in power generating capacity due to its distressed economic situation), but rather from serious inefficiencies in electricity production, distribution and consumption. The independent panel had therefore concluded that financing the completion of the two partly built Ukrainian reactors did not represent the most cost-effective use of Western funds. Rather, the least-cost approach to Ukraine's energy problems was to enhance the operational reliability and efficiency of the country's existing power plants and transmission and distribution grid and to reduce excess demand by promoting energy efficiency schemes among industrial and residential energy consumers. In short, the efficiency of the transaction (second dimension) was rather low because the Western donors could have likely secured a comparable behavioral change on the part of Ukraine at lower cost by refraining from financing the expensive K2/R4 project and instead funding alternative, more cost-effective capacity-building measures.

To which extent did the theoretically predicted problems in designing and implementing positive incentives shape the effectiveness and efficiency of the transaction? At first sight it appears that *extortion problems* negatively affected the efficiency of the transaction. Indeed, throughout the negotiation and MoU implementation process the Ukrainian government had repeatedly threatened to prolong the service life of the unsafe Chernobyl NPP—i.e. to expose the Western countries to significantly enhanced levels of environmental risk—unless the Western donors provided sufficient assistance and/or delivered the pledged assistance more swiftly. Moreover, the Ukrainian government was probably not genuinely interested in the prolonged operation of the Chernobyl NPP—most

Ukrainian decision-makers were most likely aware of the serious safety risks posed by this course of action—, but rather used the threat to modernize the ill-fated plant for long-term operation as a powerful bargaining chip to gain as much compensation as possible in exchange for the plant's premature closure. Finally, the Ukrainian bargaining strategy appears to have been relatively successful in extracting a considerable amount of compensation from the West: Even though the Ukrainian government did not gain all of the assistance that it had originally demanded, it certainly received more compensation than it could have expected in late 1993.

Despite these observations, the Ukrainian government's bargaining strategy does not strictly speaking qualify as extortion because Kiev would have likely delivered on its threat to resuscitate the Chernobyl NPP if the Western donors had refrained from providing compensation. This key assumption is based on the following reasoning. A refusal of the West to help pay for the closure of the Chernobyl NPP would have forced the Ukrainian government to chose between two unappealing options: Either the continued operation of the unsafe Chernobyl NPP or the costly decommissioning of the plant without external assistance. Given Ukraine's critical economic and energy situation, it is likely that the Ukrainian government would have opted for the continued operation of the Chernobyl NPP, simply because this option was less "bad" than the remaining alternative. Indeed, the unilateral decommissioning of the Chernobyl NPP would have not only resulted in lost energy production and social dislocation, but would have left the cash-strapped Ukrainian government to cope with a number of environmental problems that exceeded all available resources. In short, the Ukrainian government did not bluff the Western donors into offering "money for nothing": If the West had refused to provide compensation in exchange for the closure of the Chernobyl NPP, the Ukrainian government would have likely carried out its threat to resuscitate the ill-fated plant. As such the efficiency of the transaction was not negatively affected by extortion problems. Moreover, the Ukrainian government's bargaining strategy did not hamper the effectiveness of the transaction in the sense of discouraging the Western donors from providing positive incentives in exchange for the premature closure of the Chernobyl NPP.

Moral hazard problems did not negatively affect the effectiveness and efficiency of the transaction. At first sight this conclusion may be surprising. Indeed, it is plausible to suggest that by postponing the scheduled closure date of the Chernobyl NPP in late 1993 and by subsequently making every effort to keep the ailing third unit of the plant in operation, the

Ukrainian government had engaged in risky activities, i.e. activities which exposed the Western countries to an elevated level of environmental risk. Moreover, it seems that the Ukrainian government undertook these risky activities—at least in part—in the expectation or hope that they would lead to the provision of external assistance. However, the Ukrainian government did not postpone the closure of the Chernobyl NPP and seek to keep the decrepit third unit of the plant in operation because it expected that these risky activities would entice the Western donors to provide the resources required to reduce to an acceptable level the risks connected with the continued operation of the Chernobyl NPP. Rather, the Ukrainian government undertook these activities in the expectation that they would induce the Western donors to provide the assistance required to close the Chernobyl NPP, i.e. to eliminate the safety threat posed by the continued operation of the unsafe plant. As such the behavior of the Ukrainian government does not qualify as moral hazard.

The effectiveness of the transaction was to a certain extent hampered by *distribution and information problems*. From the outset of the negotiation process, the Ukrainian government sought to extract the maximum amount of compensation from the G-7 and EU by exaggerating the costs of complying with Western closure demands—Ukrainian estimates of the costs involved in closing and decommissioning the Chernobyl NPP varied between $4.5 billion and $12 billion—and understating the benefits of solutions proposed by the Western negotiating parties. Not surprisingly, the intense conflicts between the negotiating partners over the costs and benefits of cooperation seriously protracted the negotiating process. Indeed, it took nearly two years of diplomatic haggling over the amount and type of compensation until a closure deal could be finally concluded in the framework of the MoU. Moreover, despite the apparent resolution of the conflict in December 1995, implementation of the Chernobyl closure plan subsequently stalled as a result of Ukrainian dissatisfaction with the terms of the MoU, in particular with the size and composition of the Western assistance—Ukraine insisted on a greater grant portion—and with the slow disbursement of the pledged aid. Information problems contributed to the delays in concluding and implementing the closure deal. The negotiation and MoU implementation process was protracted not least due to the difficulties the Western donors encountered in determining how much the closure of the Chernobyl NPP would cost and which specific measures were the most cost-effective to enable and induce Ukraine to comply with Western closure demands.

The effectiveness of the transaction was not negatively affected by *enforcement problems*. As a matter of fact, since the Ukrainian government ultimately complied with its

closure commitments, it proved unnecessary for the Western donors to enforce the MoU. It is interesting to note that even if the Ukrainian government had reneged on its closure commitments, the Western donors would have not faced serious enforcement problems. Indeed, a considerable amount of the pledged Western assistance was earmarked for long-term projects, such as for the reconstruction of the sarcophagus, or for projects that were inextricably linked to the closure of the Chernobyl NPP, such as for the decommissioning of the plant. Under these circumstances it would have been relatively unproblematic for the Western donors to threaten to withhold the earmarked funds in case the Ukrainian government backtracked on its closure commitments. And given Ukraine's strong interest in the realization of these Western-funded projects, it is rather likely that a Western threat along these lines would have been sufficient to secure Ukrainian compliance with its closure commitments.

The specific *problem-definition* adopted by the Western donors did have a negative impact on the efficiency of the transaction. In determining how to help Ukraine cope with its energy problems and hence overcome an important obstacle to the premature closure of the Chernobyl NPP, various Western governments adhered to a pro-nuclear problem-definition that precluded the funding and implementation of more cost-effective capacity-building measures. Indeed, even though various opportunities existed to address Ukraine's energy problems more effectively and at lower cost than completing the Khmelnitsky-2 and Rovno-4 reactors, various important Western donors were reluctant to abandon the K2/R4 project in favor of alternative energy projects and used their political influence to ensure that the costly nuclear completion project, after much delay, was tentatively approved for loan financing in December 2000.

This pro-nuclear problem-definition was clearly a result of the strategic and in particular commercial interests of a number of influential Western donor states and their respective nuclear industries. On the one hand, various Western donors, in particular the United States, considered the completion of the K2/R4 project as an appropriate strategic means to reduce Ukraine's reliance on Russian fossil fuel deliveries—a source of political vulnerability that Russia had been eager to exploit—and thereby to safeguard Ukraine's precarious independence. It is telling in this respect that the G-7 had rejected the Ukrainian government's proposal in early 1995 to replace the Chernobyl NPP with a new thermal power plant on the grounds that this option threatened to deepen Ukraine's dependence on Russian gas imports and increase its debt with Russia. On the other hand, various important Western

governments viewed the nuclear completion project as a convenient way to subsidize their ailing nuclear industries. Indeed, the realization of the K2/R4 project would not only provide the leading Western nuclear engineering firms with much needed nuclear upgrade and completion work, but also promised to pave the way for the Western-led completion of other partly built VVER-1000 reactors in the FSU. In short, due to the strategic and in particular commercial interests of various Western governments, the Western donors adhered to a pro-nuclear problem-definition that precluded the funding and implementation of potentially more effective and less expensive capacity-building measures.

The *"slippery slope effect"* did not hamper the effectiveness of the transaction. At first sight this conclusion may be surprising when taking into account that the Western donors—via the NSA—had agreed to provide around ECU 13 million for near-term safety upgrades at the third unit of the Chernobyl NPP. However, since the amount of safety-enhancing equipment installed at Chernobyl unit 3 was minimal and did not significantly alleviate the reactor's severe safety deficiencies, it is plausible to suggest that the implementation of this specific capacity-building measure did not tempt or enable the Ukrainian government to extend the service life of the third unit of the Chernobyl NPP.

The effectiveness of the transaction was to a certain extent negatively affected by *coordination problems*. Indeed, coordination problems among the Western donors seriously delayed the provision of Western loans for the K2/R4 project, which in turn hampered the effective implementation of the MoU. From the outset of the negotiation process, the Western donors were confronted with the controversial issue over how to compensate Ukraine for the shortfall in electricity that would result from the early closure of the Chernobyl NPP. After much debate over this issue both within the group of Western donor states and between the Western donors and Ukraine, the governments of the G-7 countries and the European Commission decided in late 1995 to fund the completion of the two partly built Khmelnitsky-2 and Rovno-4 reactors as the principal Chernobyl power replacement project. Following the inclusion of this investment target in the MoU, the G-7 countries instructed the EBRD to assume the leading role in financing the K2/R4 project.

However, the EBRD subsequently proved both unable and unwilling to promptly comply with this request. This was especially true after the independent panel had concluded in early 1997 that the plan to complete the two unfinished Ukrainian VVER-1000 reactors did not represent the most cost-effective use of Western funds. Since the EBRD was obliged under its own charter to adhere to stringent banking principles, the panel's conclusion in

effect barred the EBRD from funding the nuclear completion project. The resulting impasse over loan financing for the K2/R4 project did not only jeopardize the early closure of the Chernobyl NPP, but also threatened the strategic and commercial interests of various Western donor states and their nuclear industries. The leading Western donor states hence prevailed upon the EBRD to commission a second external review of the project's cost-effectiveness. This second economic assessment concluded in May 1998 that there was a 50 percent probability that the completion of the Khmelnitsky-2 and Rovno-4 reactors constituted the least-cost approach to Ukraine's energy needs. Although the conclusions of the second external review, combined with the ongoing political pressure from the major Western donor states, saved the K2/R4 project from certain demise, the EBRD continued to have serious doubts about the project's financial viability and remained rather reluctant to shoulder the considerable financial risk of the project. As a result, the EBRD did not only insist on increasingly stringent loan conditions, but also repeatedly delayed its final decision on loan financing for the project.

In addition, a widening fissure among the major Western donor states contributed to the delayed provision of Western loans for the K2/R4 project. In June 1999, just days before the G-7 was expected to endorse the project and hence pave the way for a positive EBRD board decision, the Bundestag voted against German participation in the funding of the K2/R4 project and called on the German government to support non-nuclear options in Ukraine instead. As a result of this domestic political pressure, the new German government under Gerhard Schröder subsequently opposed the nuclear completion project. In sum, coordination problems among the Western donors seriously delayed the provision of loans for the K2/R4 project. These repeated delays, in turn, hampered the effective implementation of the MoU by prompting the Ukrainian government to keep the remaining operational unit of the Chernobyl NPP in operation as long as possible.

9 CONCLUSIONS

In the past decades both the growing number of transnational environmental problems and their relentless aggravation have increased the need for successful international environmental cooperation. After various attempts at the international level during the 1970s and 1980s had failed to solve a number of outstanding transnational environmental problems, a major change in strategy occurred in the early 1990s. Since then the provision of positive incentives, i.e. transfers of positively valued resources such as money, technology and know-how from one actor to another, has been increasingly regarded as the most promising policy tool to foster international environmental cooperation, in particular in those cases in which the active participation of so-called capacity-poor countries is required. With a view to the growing popularity of this cooperation strategy in international environmental politics, it comes somewhat as a surprise that analysts of international relations have with some rare exceptions not yet systematically analyzed the advantages and drawbacks of positive incentives, and the conditions under which positive incentives are effective and efficient. Aspiring to fill this research gap, this book has sought to find answers to the following research question: When and how can positive incentives foster international cooperation so as to solve transnational environmental problems in effective and efficient ways and what are the problems that typically arise when bringing positive incentives to bear.

Drawing and expanding on existing theoretical insights into the role of positive incentives in fostering international cooperation, this book has developed an analytical framework that guides the empirical research on the question outlined above. The outcomes to be explained in this study are the effectiveness and efficiency of positive incentives. Positive incentives are conceptualized as transactions, i.e. as transfers of positively valued resources, such as money, technology and know-how, from one actor to another with the aim of driving the behavior of the recipient in a direction that is desirable from the point of view of the provider. The effectiveness of a transaction denotes the extent to which the provision of positive incentives drove the behavior of the recipient state in a direction desired by the provider state. The efficiency of a transaction refers to the cost-effectiveness of positive incentives. In other words, the efficiency of a transaction relates to the question of whether the providers of positive incentives paid too much for what they gained in terms of environmental benefits resulting from the behavioral changes on the part of the recipient. The concept of efficiency used in this study encompasses two related, nevertheless distinct dimensions. The first dimension of efficiency relates to the question of whether the

employment of cooperation strategies other than positive incentives—i.e. positive issue-linkage, negative incentive, cognitive and normative strategies—could have led to comparable or superior behavioral changes on the part of the recipient country at a lower or comparable cost. The second dimension of efficiency relates to the question of whether alternative ways of employing positive incentives—i.e. the funding and implementation of other capacity-building measures—could have resulted in comparable or superior behavioral changes on the part of the recipient country at a lower or comparable cost. The explanatory concepts of the analytical framework are operationalized in terms of problems that typically arise when designing and implementing positive incentives and that may have an impact on the effectiveness and/or efficiency of a transaction. These problems, which are derived from various social science theories and build upon the results of empirical research on incentives in various areas of international relations, are outlined below.

Both the effectiveness and efficiency (first dimension) of transactions may be hampered by problems of *extortion and moral hazard*. On the one hand, a recipient state may seek to extract payments from provider states by bluffing the latter into believing that it would engage in some externality-generating or externality-enhancing behavior if not rewarded for refraining from doing so. On the other hand, the prospect of external environmental assistance may induce a would-be recipient state to engage in overly risky behavior because it expects that other countries will provide the necessary resources to reduce the harmful effects of its risky behavior to an acceptable level. Moreover, both extortion and moral hazard problems may deter provider states from engaging in mutually beneficial transactions. *Information and distribution problems* are two closely related problems that may hamper transactions. Indeed, negotiations on the exchange of positive incentives for externality-reducing behavioral changes on the part of the recipient may falter as a result of "stingy" bargaining behavior by the negotiating parties or due the absence of sufficient information on the exact value of the object under negotiation. *Enforcement problems* can also negatively affect the effectiveness of transactions. Provider states may lack the means to enforce international environmental agreements, or they may be reluctant to do so for normative or practical reasons, or because such action often inflicts considerable economic and political costs on the enforcing states as well. The efficiency (second dimension) of transactions may be seriously hampered by the specific *problem-definition* adhered to by the providers of positive incentives, i.e. by the specific way the donors chose to define and hence address an environmental problem. The "*slippery slope effect*", which may hamper the effectiveness of transactions, relates to the risk

that resources transfers aimed at enabling a recipient state to renounce an undesirable behavior and adopt a new desirable behavior may unintentionally induce and/or enable the recipient state to continue its previous undesirable behavior, albeit at marginally less detrimental levels. Finally, *coordination problems* among the provider states may negatively affect the effectiveness of transactions by leading to a sub-optimal provision of resources or by frustrating efforts to establish a united donor front capable of imposing conditions on environmental assistance programs.

The analytical framework developed in this book is built upon the following *basic hypothesis*: The more the designated problems crop up in a transaction both in terms of their occurrence and intensity, or conversely, the less successful the provider states are in coping with these problems, the lower the effectiveness and/or efficiency of the transaction. That said, it must be emphasized that the basic analytical framework is not so much designed to allow for rigorous hypothesis testing but rather aims to provide a checklist of problems that typically arise when employing positive incentives. Indeed, this caveat should not be surprising with a view to the fact that it is difficult if not impossible to precisely gauge the exact influence of each problem on the outcomes to be explained. Hence, the analytical framework is best viewed as a useful analytical tool to evaluate and explain in empirical cases whether and how the theoretically predicted problems individually or collectively affected the effectiveness and/or efficiency of a transaction.

The propositions of the analytical framework have been investigated by means of case studies derived from one specific issue-area of international environmental politics: The transboundary safety threat posed by the continued operation of unsafe Soviet-designed nuclear reactors in CEE and the FSU. In 1990/1991 a series of IAEA fact-finding missions had shocked the governments and populations of Western Europe and other countries with the alarming judgment that a serious accident at one of the 58 operational Soviet-designed nuclear reactors in CEE and the FSU could occur unless safety conditions were improved immediately. Moreover, Western nuclear safety experts had concluded that certain Soviet-designed reactor types—i.e. the VVER-230s and RBMKs, or so-called high-risk nuclear reactors—could not be upgraded to reach acceptable safety standards and hence should be shut down as soon as possible. Widespread concern about the transboundary environmental and political effects of a further Chernobyl-style nuclear catastrophe in the East was the driving force behind the subsequent actions of various Western governments and international organizations to address the nuclear safety problem in CEE and the FSU. Indeed, the April

1986 nuclear accident at the Chernobyl NPP in Ukraine had not only exposed the populations of various Western European countries to sharply elevated levels of radiation and caused considerable economic damage, but had also nearly destroyed public acceptance of nuclear power in the West.

In addressing the nuclear safety problem in CEE and the FSU, Western governments and international organizations did not only seek to secure risk-reducing, but ultimately also risk-eliminating behavioral changes on the part of those Eastern countries operating VVER-230s and RBMKs. In other words, whereas concerned Western governments and international organizations could reduce the risk of a nuclear accident in CEE and the FSU to a certain extent by helping the Eastern countries to improve safety conditions at their Soviet-built NPPs, a lasting and satisfactory solution to the nuclear safety problem in CEE and the FSU could only be secured if the Eastern countries closed their operational VVER-230 and RBMK reactors as soon as possible. However, the countries of CEE and the FSU were reluctant to prematurely close their high-risk nuclear reactors in the near-term because they depended to varying degrees on the power generated at these units and lacked the means to cope with the economic and social costs of closure. Realizing that the Eastern countries faced severe constraints in cooperating in the nuclear safety field, various Western countries and international organizations offered significant amounts of nuclear safety and other assistance in exchange for commitments on the part of various Eastern governments to improve nuclear safety and—most important—to prematurely close their unsafe Soviet-designed nuclear reactors. Within the overall international effort to improve nuclear safety in CEE and the FSU, seven distinct transactions in which Western donors provided or attempted to provide positive incentives in exchange for risk-reducing and in particular risk-eliminating behavioral changes on the part of Eastern recipient countries have been selected for analysis. Each case study conducted in this book analyzes a transaction over time, with the exception of one case study that for practical reasons examines three distinct transactions. The five case studies on the seven selected transactions that materialized in the nuclear safety are outlined below.

Case study I: In June 1993, the NSA concluded a grant agreement with the Bulgarian government. The NSA agreed to provide ECU 24 million for near-term safety upgrades at the four older VVER-230 units of the Kozloduy NPP and IFIs promised to allocate an unspecified amount of favorable loans for various energy projects in exchange for the commitment on the part of the Bulgarian government to prematurely close Kozloduy units 1-4 by 1997/1998. In early 1998, following the successful implementation of the NSA-funded safety upgrade

program, the Bulgarian government refused to comply with its closure commitments on the grounds that international funding for the rehabilitation of the country's energy sector had not sufficiently materialized and announced plans to further upgrade Kozloduy units 1-4 for long-term operation.

Case Study II: In February 1994, the NSA concluded a grant agreement with the Lithuanian government. The NSA agreed to allocate around ECU 40 million for near-term safety upgrades at the Ignalina NPP and IFIs promised to provide an unspecified amount of low-interest loans for the rehabilitation of Lithuania's power sector in exchange for the commitment on the part of the Lithuanian government to comply with certain measures aimed at securing the early closure of the plant's two RBMK units. By early 1998, and after most NSA-funded safety upgrade projects had been implemented, it had become apparent that the Lithuanian government was preparing to keep the Ignalina NPP in operation as long as possible.

Case Study III: Throughout 1994 and 1995, the EBRD sought to conclude a deal with the Slovak government according to which the Slovak Republic would receive a substantial amount of low-interest loans for the completion and upgrading of two modern, partly built nuclear reactors at the Mochovce NPP in exchange for the commitment to prematurely close two unsafe units at the Bohunice NPP by the year 2000 or once the two Mochovce units were completed. After drawn out negotiations, the Slovak government rejected the EBRD's closure deal in late 1995 and subsequently made preparations to prolong the service lives of Bohunice units 1-2.

Case Study IV: Since it had become evident by 1998 that the Slovak Republic, Lithuania and Bulgaria were planning to abandon previously made unilateral or international closure commitments and to prolong the service lives of their high-risk nuclear reactors, the European Commission intervened into the ongoing closure dispute to secure the earliest possible closure of these nuclear reactors. From late 1998 on, the Commission sought to extract "realistic" closure commitments from the three Eastern European applicant countries by linking their prospects to begin EU membership negotiations to a cooperative stance on the closure issue. Moreover, from mid-1999 on the Commission also offered each country a substantial amount of decommissioning aid in exchange for the establishment of "realistic" closure commitments. In late 1999 the closure negotiations were concluded with the following results: The Slovak Republic promised to close Bohunice units 1-2 in 2006 and 2008. Lithuania agreed to close Ignalina unit 1 by 2005 and to decide on a definitive closure

date for unit 2 in 2004. Finally, Bulgaria pledged to shut down Kozloduy units 1-2 in 2003 and to fix a definitive closure date for Kozloduy units 3-4 in 2002. It is expected that Kozloduy units 3-4 will be closed in 2006-2008/10.

Case Study V: From 1994 on, the G-7/EU and Ukraine were engaged in negotiations over the premature closure of the Chernobyl NPP. The closure of the remaining operational units of the Chernobyl NPP (units 1 and 3) had become an object of contention due to the Ukrainian parliament's October 1993 decision to rescind its earlier resolution to close these two units by the end of 1993 and to approve plans to upgrade the ill-fated plant for long-term operation. Deeply concerned about the prospect of the crippled Chernobyl NPP being granted a new lease on life, the G-7/EU sought to induce the Ukrainian government to close Chernobyl units 1 and 3 as soon as possible and to refrain from restarting Chernobyl unit 2. After almost two years of diplomatic wrangling over the amount of money requested by the Ukrainian government, the negotiating parties concluded in December 1995 a Memorandum of Understanding (MoU) in which the Western donors agreed to provide $2.3 billion in assistance in exchange for the closure of the Chernobyl NPP by 2000. The MoU envisaged around $500 million in grants for various projects related to the plant's early closure and $1.8 billion in loans for the completion of the two partly built Khmelnitsky-2 and Rovno-4 reactors (the so-called K2/R4 project) and the modernization of existing hydroelectric and thermal power plants. Implementation of the MoU turned out to be a problem-ridden and bumpy process, mainly because disagreement prevailed over the question of whether the Western donors should fund the K2/R4 project. As a result of the impasse over the K2/R4 project, the Ukrainian government repeatedly threatened to restart Chernobyl unit 2 and to postpone the closure of unit 3 if funding for the nuclear completion project was not provided on schedule. Moreover, Kiev undertook strenuous efforts to keep Chernobyl unit 3 running, despite the fact that the debilitated reactor was in constant need of repairs and clearly unfit for continued operation. Nevertheless, on 15 December 2000, a year later than anticipated by the MoU and only days after the Western donors had tentatively approved loans for the K2/R4 project, the Ukrainian government ordered the definitive closure of the Chernobyl NPP.

In this final chapter of the book I summarize and compare the results of the empirical case studies and proceed as follows. I first explore the extent to which the various Eastern recipient countries changed their behavior in a direction desired by the Western donors. Second, I describe the various cooperation strategies and capacity-building measures employed by the Western donors to influence the behavior of the Eastern recipient countries.

In a third step I determine the extent to which the observed behavioral changes on the part of the recipient countries was influenced by the provision of positive incentives—controlling for the possible effects of other employed cooperation strategies—, and evaluate the effectiveness of the seven examined transactions. In a fourth step I assess the efficiency of the examined transactions by evaluating whether the Western donors could have secured comparable or superior behavioral changes on the part of the Eastern recipient countries at a lower or comparable cost by resorting to a cooperation strategy other than positive incentives and/or by employing positive incentives in different ways. Finally, I assess the extent to which the theoretically predicted problems in designing and implementing positive incentives shaped the effectiveness and efficiency of the seven examined transactions.

The extent to which the Eastern recipient countries changed their behavior in a direction desired by the Western donors varied significantly in the seven examined transactions. In those two transactions in which the NSA was the principal Western donor, the Eastern recipient countries—Bulgaria and Lithuania—did carry out measures to reduce the risk of a nuclear accident at their unsafe NPPs, but ultimately refused to comply with their closure commitments. In other words, in these two transactions the Eastern recipient countries adopted risk-reducing, but no risk-eliminating behaviors. In the attempted transaction between the EBRD and the Slovak Republic, the would-be recipient country—by rejecting the EBRD's closure deal and subsequently making preparations to prolong the service lives of Bohunice units 1-2—failed to change its behavior in a direction desired by the Western donors. In those three transactions in which the European Commission sought to extract "realistic" closure commitments from the Slovak Republic, Lithuania and Bulgaria, the three Eastern recipient countries more or less changed their behavior in a direction desired by the Western donors. Indeed, even though only Lithuania's new closure commitments were fully in line with the European Commission's original closure demands—the closure schedules conceded by the Slovak Republic and Bulgaria were somewhat delayed compared to what the Commission had initially demanded—, all three Eastern recipient countries did firmly commit themselves to the premature closure of their high-risk nuclear reactors. Finally, in the transaction between the G-7/EU and Ukraine aimed at securing the premature closure of the Chernobyl NPP, the Eastern recipient country also more or less changed its behavior in a direction desired by the Western donors. Indeed, the Ukrainian government agreed to close Chernobyl unit 1 in November 1996 and refrained from modernizing and restarting Chernobyl unit 2. Moreover, although the Ukrainian government made every effort to keep the

debilitated third unit of the Chernobyl NPP on line as long as possible, it ultimately did close this unit in mid-December 2000.

In seeking to induce and enable the Eastern recipient countries to adopt risk-reducing and in particular risk-eliminating behaviors, the Western donors employed predominantly positive incentive strategies. In its two closure agreements with Bulgaria and Lithuania, the NSA agreed to provide ECU 24 million in grants for near-term safety upgrades at Kozloduy units 1-4 and around ECU 40 million in grants for a near-term safety upgrade program and an in-depth safety assessment at the Ignalina NPP. In addition, both NSA grant agreements were based on the understanding that various IFIs such as the EBRD or the World Bank would provide an unspecified amount of favorable loans for the rehabilitation of these countries' energy sectors. By offering a substantial amount of low-interest loans under long-term repayment conditions for the completion and upgrading of the two partly built Mochovce reactors, the EBRD sought to employ a positive incentive strategy to induce and enable the Slovak government to prematurely close Bohunice units 1-2. In its attempt to extract "realistic" closure commitments from the Slovak Republic, Lithuania and Bulgaria, the European Commission eventually offered each applicant country a substantial package of positive incentives predominantly in the form of decommissioning aid: Whereas the Slovak Republic was granted Euro 110 million for decommissioning activities at Bohunice units 1-2, Lithuania was expected to receive at least Euro 100 million for the decommissioning of Ignalina units 1-2 and additional decommissioning aid at a forthcoming pledging conference. Bulgaria, on the other hand, was offered Euro 200 million in decommissioning aid plus a Euratom loan of up to Euro 250 million for the modernization of Kozloduy units 5-6.

Finally, in seeking to induce and enable Ukraine to prematurely close Chernobyl units 1 and 3 by 2000 and to refrain from modernizing and restarting the plant's second unit, the G-7/EU provided a substantial package of positive incentives. After having gradually increased their compensation offers, the Western donors agreed in the December 1995 MoU to provide $2.3 billion—$500 million in grants and $1.8 billion in loans—to assist the hard-pressed country with the solution of various Chernobyl-related problems and to compensate Ukraine for the power lost by the plant's closure. Western grants, which ultimately exceeded the $500 million envisaged by the MoU, were earmarked for a wide array of measures designed to improve nuclear safety at the Chernobyl NPP, decommission the plant, reconstruct the ailing shelter over the destroyed fourth unit, and to mitigate the social consequences of the plant's closure. Moreover, a number of IFIs and bilateral donors disbursed or tentatively approved

approximately $700 million in favorable loans for the realization of various conventional energy projects. Last but not least, after much delay the EBRD tentatively approved in December 2000 loan financing for the K2/R4 project. Provided that the Ukrainian government does meet the EBRD's stringent loan conditions, Ukraine will receive over $1.2 billion in favorable loans from various IFIs and bilateral donors for the nuclear completion project.

In the seven examined transactions, the Western donors did not only provide positive incentives, but also employed a number of other cooperation strategies to secure risk-reducing and risk-eliminating behavioral changes on the part of the Eastern recipient countries. The Western donors employed a *positive issue-linkage strategy* at one stage of the negotiation process over the premature closure of the Chernobyl NPP: In May 1995 the EU linked the disbursement of around ECU 200 million in macro-economic assistance to Ukrainian compliance with its Chernobyl closure plan. In four examined transactions the Western donors also resorted to *negative incentive strategies*. In the transaction between the G-7/EU and Ukraine, negative incentives were employed at least twice during the protracted negotiation process: In the fall of 1994 the EU had grown so incensed about the Ukrainian government's apparent reluctance to compromise on the Chernobyl closure issue that it froze an already approved ECU 85 million balance of payments loan. And in late 1995 a number of G-7 countries sought to entice the Ukrainian government to sign the MoU by threatening to withhold an unspecified amount of Western loans. Furthermore, the European Commission employed a negative incentive strategy to induce the Slovak Republic, Lithuania and Bulgaria to close their high-risk nuclear reactors as soon as possible. Indeed, from late 1998 on the Commission had repeatedly warned the three Eastern European applicant countries that their EU membership prospects was contingent upon the establishment of "realistic" closure commitments.

The employment of *cognitive strategies* was explicitly foreseen in the NSA agreement with Lithuania. By conducting an in-depth safety assessment of the Ignalina NPP, the Western donors sought to provide the Lithuanian nuclear safety authority with the necessary technical information to decide on whether the continued operation of Ignalina unit 1 beyond mid-1998 could be justified on safety grounds. Moreover, the Western donors also sought to provide the Lithuanian authorities with more reliable information on the full economic costs of operating the Ignalina NPP by commissioning least-cost studies of the country's energy needs. Cognitive strategies were also employed in the transaction between the G-7/EU and

Ukraine: By conducting a series of safety studies and least-cost investment analyses the Western donors sought to furnish the Ukrainian authorities with more reliable information concerning both the risks of keeping the Chernobyl NPP in operation and the costs and benefits of alternative energy strategies. Finally, all seven examined transactions included the employment of *normative strategies*. At countless rounds of negotiations and talks, Western officials and nuclear safety experts sought to persuade the Eastern recipient governments through dialogue and education to attach higher policy priority to nuclear safety issues and to prematurely close their high-risk nuclear reactors on safety grounds. The following table summarizes which cooperation strategies were employed in which transactions.

TABLE 9.1: COOPERATION STRATEGIES EMPLOYED BY WESTERN DONORS IN THE EXAMINED TRANSACTIONS

Case Study Donor — Recipient(s)	Positive Incentive Strategies	Positive Issue-Linkage Strategies	Negative Incentive Strategies	Cognitive Strategies	Normative Strategies
Case Study I NSA — Bulgaria	■				■
Case Study II NSA — Lithuania	■			■	■
Case Study III EBRD — Slovak Republic	■				■
Case Study IV European Commission — Applicant countries	■		■		■
Case Study V G-7/EU — Ukraine	■	■	■	■	■

The empirical analysis of the seven transactions suggests that the observed behavioral changes on the part of the Eastern recipient countries were to a large extent attributable to the provision of positive incentives. This assessment is based on the following observations. On the one hand, the provision of positive incentives appears to have been a necessary, if not always a sufficient means to drive the behavior of the Eastern recipient countries in a direction desired by the Western donors. Indeed, in all examined transactions, the Eastern recipient countries demanded and—to varying degrees—required positive incentives to adopt risk-reducing and risk-eliminating behaviors. Bulgaria and Lithuania neither disposed over the financial and technical means to reduce the risk of a nuclear accident at the Kozloduy and Ignalina NPPs, nor were they willing and/or able to cope with the costly implications of prematurely closing their high-risk nuclear reactors without external assistance. The Slovak

government, in turn, had credibly signaled to the Western donors that it would be willing and capable to prematurely close Bohunice units 1-2 only if international loan financing for the completion of Mochovce units 1-2 was forthcoming. Moreover, as the European Commission sought to extract "realistic" closure commitments from the Slovak Republic, Lithuania and Bulgaria, the three applicant countries argued—and quite credibly so—that they would not be willing and/or able to prematurely close their high-risk nuclear reactors if the Commission refused to provide some sort of compensation.

Finally, the Ukrainian government had made it clear to the Western donors that the closure of the Chernobyl NPP would entail severe political, financial and social costs that the cash-strapped country was both unable and unwilling to bear on its own. Indeed, although the power generated by the Chernobyl NPP accounted for only about 6 percent of the country's total electricity supply, this was still a considerable amount of energy to forego at a time when Ukraine was struggling to cope with a severe energy and economic crisis and when Russia was eager to exploit Ukraine's massive debts for natural gas imports to gain political concessions in other outstanding bilateral issues. In addition, even if ways could be found to replace the power produced by the Chernobyl NPP, Ukraine would still have to cope with a number of costly and complex problems associated with the plant's closure that clearly exceeded its financial and technical capacities.

On the other hand, it is plausible to suggest that the employment of other cooperation strategies did not significantly influence the observed behavioral changes on the part of the Eastern recipient countries. Indeed, whereas the EU's May 1995 offer to grant ECU 200 million in macro-economic assistance provided that the Ukrainian government stuck to its Chernobyl closure plan may have induced Kiev to adopt a more cooperative stance during the negotiation process, it is rather unlikely that this positive issue-linkage significantly enhanced the Ukrainian government's willingness and capacities to prematurely close the Chernobyl NPP. Similarly, while the EU's temporary suspension of an ECU 85 million balance of payments loan to Ukraine and the threat by various G-7 countries to withhold an unspecified amount of loans may have enticed the Ukrainian government to return to the negotiating table and to sign the December 1995 MoU, the effects of these negative incentive strategies on the final outcome of the negotiation process were probably small. It is somewhat more difficult to assess the extent to which the three applicant countries altered their behavior as a result of the negative incentive strategy employed by the European Commission. On the one hand, there seems to be little doubt that the Commission's negative incentive strategy had a significant

impact on the applicant countries' willingness to cooperate in the nuclear safety field. Indeed, since these three countries were strongly interested in securing the economic and strategic benefits of EU membership as soon as possible, the Commission's strategy of linking their EU membership prospects to the establishment of "realistic" closure commitments exerted considerable pressure on them to compromise. On the other hand, it is doubtful whether the negative incentive strategy was sufficient for inducing the applicant countries to establish "realistic" closure commitments. In other words, it is possible that the three applicant countries would have refused to cooperate, or would have conceded far less favorable closure schedules, if the Commission had resorted exclusively to the negative incentive strategy and had not provided positive incentives in the form of decommissioning aid. As such the negative incentive strategy employed by the European Commission was perhaps a necessary, yet insufficient means to extract "realistic" closure commitments from the three applicant countries.

The employment of cognitive strategies in the transactions between the NSA and Lithuania, on the one hand, and the G-7/EU and Ukraine, on the other, did not have any discernible effects on the behavioral changes of the recipient countries. Finally, the employment of normative strategies in the seven examined transactions, while possibly enhancing the willingness of the Bulgarian and Lithuanian governments to carry out externally funded safety upgrades at their high-risk nuclear reactors and to attach higher priority to nuclear safety matters, clearly failed to induce the Eastern recipient countries to adopt risk-eliminating behaviors.

Based on the considerations outlined above, we can summarize the effectiveness of the seven examined transactions as follows. The effectiveness of the transactions between the NSA and Bulgaria, on the one hand, and between the NSA and Lithuania, on the other, was rather low. Indeed, although positive incentives resulted in reduced risk-levels at the Kozloduy and Ignalina NPPs, they ultimately failed to secure the premature closure of these high-risk nuclear reactors. The effectiveness of the attempted transaction between the EBRD and the Slovak Republic was low: Since the Slovak government rejected the EBRD's closure deal and subsequently made preparations to prolong the service lives of Bohunice units 1-2, the attempted transaction failed to drive the Slovak Republic's behavior in a direction desired by the Western donors. The effectiveness of the transactions between the European Commission and the three applicant countries varied slightly: Whereas the effectiveness of the transaction between the Commission and Lithuania was high, the effectiveness of the two

transactions in which the Commission sought to extract "realistic" closure schedules from the Slovak Republic and Bulgaria was rather high. This assessment is based on the following considerations. On the one hand, it is plausible to suggest that the provision of positive incentives was ultimately a necessary and effective means to extract "realistic" closure commitments from the applicant countries. On the other hand, it must be taken into account that in contrast to the closure commitments conceded by the Lithuanian government, the closure commitments offered by the Slovak and Bulgarian governments were not fully in line with the Commission's original closure demands. Finally, the effectiveness of the transaction between the G-7/EU and Ukraine was rather high: Although the Ukrainian government undertook strenuous efforts to keep the debilitated third unit of the Chernobyl NPP in operation as long as possible, which was certainly undesirable from a nuclear safety point of view, it ultimately did close the ill-fated plant in late 2000.

How high was the efficiency of the examined transactions? As far as the first dimension of efficiency is concerned, the empirical analysis suggests that the examined transactions were all efficient in the sense that the employment of no other cooperation strategy could have secured comparable or superior behavioral changes on the part of the Eastern recipient countries at a lower or comparable cost. Generally speaking, the provision of positive incentives proved to be the most cost-effective strategy to solicit recipient cooperation in the nuclear safety field because none of the other cooperation strategies analyzed in this study could have adequately addressed the key cooperation in the seven examined transactions, i.e. the Eastern countries' insufficient financial and technical resources to improve nuclear safety and—most important—to cope with the costly and complex implications of prematurely closing and decommissioning their high-risk nuclear reactors. Indeed, whereas the employment of positive issue-linkage strategies may have increased the recipient countries' incentives to cooperate, such strategies would have not enabled the Eastern recipient countries to reduce the risk of a nuclear accident at one of their Soviet-built NPPs or enhanced their capacities to deal with the potentially severe socio-economic and political costs and technically complex task of prematurely closing and decommissioning high-risk nuclear reactors. Moreover, in most if not all examined transactions there were no easily identifiable positive issue-linkages that the Western donors could have readily agreed upon and that would have generated sufficiently large incentives for the Eastern recipient countries to adopt risk-eliminating behaviors in the near-term.

Similar reasons explain why negative incentives were unlikely to be more cost-effective than positive incentives. Economic sanctions were unlikely to entice the Eastern recipient countries to develop the necessary technical and financial means to improve nuclear safety or to prematurely close and decommission their high-risk nuclear reactors. Moreover, while the threat or imposition of economic sanctions may have enhanced the Eastern countries' perceived costs of non-cooperation, it is debatable whether such measures would have been sufficient to induce the Eastern governments to adopt risk-eliminating behaviors. In fact, the imposition of economic sanctions risked being counterproductive by exacerbating these countries' economic problems and thereby possibly forcing them to rely even more heavily on cheap, but unsafe nuclear power. In addition, it is doubtful whether the Western donors would have been prepared to bear the potential costs involved in imposing sanctions. Indeed, it is plausible to suggest that the major Western donors would have been reluctant to put at risk their economic and strategic interests in a smooth transformation process for the sake of securing the premature closure of high-risk nuclear reactors.

Finally, it is difficult to see how the employment of normative or cognitive strategies could have led to a more favorable outcome from the Western donors' point of view. Indeed, given the strong asymmetric capacities and preferences underlying the nuclear safety problem in CEE and the FSU, it is rather unlikely that persuasion attempts or the provision of more complete information concerning the risks of keeping unsafe nuclear reactors in operation or the relative benefits and costs of alternative energy strategies would have induced the Eastern countries to adopt risk-reducing and risk-eliminating behaviors. In sum, the efficiency (first dimension) of all examined transactions was high.

As far as the second dimension of efficiency is concerned, the empirical analysis suggests that various transactions involved potentially serious inefficiencies in the sense that the Western donors could have possibly secured comparable or superior behavioral changes on the part of the Eastern recipient countries at a lower or comparable cost by employing positive incentives in different ways. Indeed, in the two transactions between the NSA and Bulgaria, on the one hand, and between the NSA and Lithuania, on the other, the Western donors could have probably secured a more favorable outcome by refraining from funding near-term technical safety upgrades at the Kozloduy and Ignalina NPPs—which ultimately had the effect of prolonging the service lives of these high-risk nuclear reactors—and instead channeling all available financial and technical assistance towards the rehabilitation of these countries' energy sectors and the promotion of energy efficiency schemes. Such an alternative

way of employing positive incentives would have probably been more successful in facilitating the premature closure of these high-risk nuclear reactors, and would have certainly avoided the risk of increasing the incentives and capacities of the recipient governments to keep these slightly improved, nevertheless still unsafe units in operation beyond the scheduled closure dates. Of course, the drawback of such an alternative funding strategy was that the Western donors would have had to endure higher levels of risk in the short-term. However, in the mid- to long-term the Western donors would have probably secured larger and more lasting safety benefits by pursuing such an alternative funding strategy.

The efficiency of the attempted transaction between the EBRD and the Slovak Republic suffered from similar problems. Instead of offering to finance the completion of the two partly built Mochovce units, the EBRD could have proposed to fund the construction of a new gas-fired power plant in exchange for the premature closure of Bohunice units 1-2. On the one hand, it is rather likely that this alternative investment option would have been less costly than the Mochovce completion project. On the other hand, it is not impossible that a closure deal involving this alternative investment option—which was far less controversial than the nuclear completion project—might have materialized. Indeed, the strong controversy surrounding the Western-led Mochovce completion project did not only undermine the Western donors' bargaining position, but may have prompted the Slovak government to consider the Czech and Russian counter-offers to complete the two Mochovce units without any substantial loan conditions.

The transaction between the G-7/EU and Ukraine involved similar inefficiencies. Indeed, it is rather debatable whether the (tentative) approval of over $1.2 billion in loans for the completion of the K2/R4 project represented the most cost-effective way to induce and enable the Ukrainian government to prematurely close the Chernobyl NPP. The independent panel commissioned by the EBRD to assess the cost-effectiveness of the K2/R4 project had made a compelling case that the construction of new power generating capacity in Ukraine was not needed and that the least-cost approach to Ukraine's energy problems was to enhance the operational reliability and efficiency of the country's existing power plants and transmission and distribution grid and to reduce excess demand by promoting energy efficiency schemes. Thus, in this transaction the Western donors could have probably secured a comparable behavioral change on the part of Ukraine at lower cost by refraining from funding the K2/R4 project and financing alternative, more cost-effective capacity-building measures instead.

In contrast, it is reasonable to suggest that the decommissioning aid pledged by the European Commission represented the most cost-effective way of employing positive incentives to extract "realistic" closure commitments from the three applicant countries. Indeed, by offering to defray a significant part of the decommissioning costs, the Commission addressed one of the main reasons why the applicant countries had been reluctant to close their high-risk nuclear reactors. Moreover, since the decommissioning aid was inextricably linked to the closure of high-risk nuclear reactors, it did not involve the risk of unintentionally encouraging and enabling the recipients to continue to engage in undesirable behaviors. In sum, the examined transactions were not equally efficient in terms of the second dimension of efficiency: Whereas the efficiency of the three transactions between the European Commission and the applicant countries was high, the efficiency of the other four examined transactions was rather low.

The discussion so far has shown that both the effectiveness and efficiency of the seven examined transactions aimed at securing risk-reducing and in particular risk-eliminating behavioral changes on the part of the Eastern recipient countries varied considerably. How can we explain this variation in outcomes? In the following I discuss whether and how the theoretically predicted problems in designing and implementing positive incentives shaped the effectiveness and efficiency of the examined transactions.

The empirical analysis suggests that neither the effectiveness nor the efficiency (first dimension) of the examined transactions were negatively affected by *extortion* problems. Indeed, since the Eastern recipient countries did not bluff the Western donors into providing resources for behavioral changes that they would have undertaken even in the absence of such resource transfers, the efficiency of the examined transactions was not hampered by extortion problems. In other words, the Western donors were not misled into offering "money for nothing". In addition, this potential problem in designing and implementing positive incentives did not affect the effectiveness of the examined transactions in the sense of deterring the Western donors from engaging in transactions with the recipient countries.

That said, it should be noted that the extent to which the recipient countries' behavior approximated extortion varied across the seven examined transactions. In those three transactions in which the NSA and the EBRD sought to secure risk-reducing and/or risk-eliminating behavioral changes on the part of the Slovak Republic, Lithuania and Bulgaria, the behavior of the Eastern recipient countries clearly did not qualify as extortion. Indeed, the three recipient countries did not threaten to adopt risk-enhancing behaviors unless rewarded

for not doing so. Rather, they simply signaled—and rather credibly so—that they lacked the financial and technical means to change their behavior in a direction desired by the Western donors. In the three transactions between the European Commission and the applicant countries, the behavior of the Eastern recipient countries came somewhat closer to extortion. By signaling their intention to renege on their unilateral and/or international closure commitments and to keep their high-risk nuclear reactors in operation unless compensation was forthcoming, the three applicant countries had implicitly threatened to adopt risk-prolonging behaviors if not rewarded for refraining from doing so. However, their behavior fell short of extortion. Indeed, with a view to the fact that the three applicant countries had a genuine interest in prolonging the service lives of their high-risk nuclear reactors—not least due to the fact that the previous safety upgrade programs funded by the Western donors had reduced the risk of a nuclear accident at one of these units—, it is rather likely that they would have delivered on their implicit threat to adopt risk-prolonging behaviors if the Commission had refused to provide some sort of compensation.

Finally, in the transaction between the G-7/EU and Ukraine, the behavior of the Eastern recipient country verged on extortion. Indeed, throughout the bargaining process, the Ukrainian government had repeatedly threatened to prolong the services lives of Chernobyl units 1 and 3 and to modernize and restart the plant's crippled second unit—i.e. to expose the Western countries to significantly enhanced levels of environmental risk—unless the Western donors provided sufficient assistance and/or delivered the pledged assistance more swiftly. In addition, it appears that the Ukrainian government was not genuinely interested in adopting such risk-enhancing behavior, but rather used the threat to resuscitate the ill-fated Chernobyl NPP as a powerful bargaining chip to extract as much compensation from the Western donors as possible. Yet also in this transaction, the behavior of the recipient did not strictly speaking qualify as extortion in the sense that the Ukrainian government bluffed the Western donors into providing resources for behavioral changes that it would have undertaken even in the absence of resource transfers. Indeed, if the Western donors had refused to provide compensation, it is rather likely that the Ukrainian government would have delivered on its threat to resuscitate the ill-fated Chernobyl NPP, simply because the remaining option—unilateral closure and decommissioning of the plant without external assistance—would have been even less appealing to Ukraine than the continued operation of the plant. In sum, whereas the behavior of the Eastern recipient countries verged to differing degrees on

extortion, this potential problem in designing and implementing did not negatively affect the effectiveness and efficiency of the examined transactions.

Neither did *moral hazard problems* negatively affect the effectiveness and efficiency (first dimension) of the examined transactions. Indeed, the empirical analysis did not uncover any compelling evidence that the Eastern recipient countries engaged in moral hazard behavior in the sense that the prospect of gaining risk-reducing nuclear safety assistance from the Western donors induced the recipient countries to refrain from unilaterally improving safety levels at their Soviet-designed nuclear reactors or to adopt otherwise overly risky behaviors. Moreover, in none of the examined transactions did this potential problem in designing and implementing positive incentives discourage the Western donors from engaging in transactions with the Eastern recipient countries. It should be noted that these conclusions hold despite the fact that in some transactions—i.e. in the two transactions between the European Commission and the Slovak Republic and Bulgaria and in particular in the transaction between the G-7/EU and Ukraine—the Eastern recipient countries did in fact engage in risky activities. Indeed, it is plausible to suggest that by postponing the scheduled closure dates for their high-risk nuclear reactors and—in the case of Ukraine—by making every effort to keep the debilitated third unit of the Chernobyl NPP in operation as long as possible, the Slovak, Bulgarian and Ukrainian governments engaged in activities that exposed the Western donors to elevated levels of environmental risk.

However, the recipient governments did not engage in such activities in the expectation that they would thereby entice the Western donors to provide the necessary resources to reduce to an acceptable level the risks associated with these activities. In fact, the willingness of the Slovak and Bulgarian governments to invest a considerable amount of their own resources in the modernization of their high-risk nuclear reactors suggests that they did not expect to obtain risk-reducing nuclear safety assistance from the Western donors by postponing the scheduled closure dates. Moreover, the Ukrainian government did not engage in risky activities in the expectation that it would thereby gain nuclear safety assistance to guarantee the continued operation of the Chernobyl NPP at lower levels of risk. If the Ukrainian government had any ulterior motives, it was the expectation that such risky behavior would induce the Western donors to provide the necessary financial and technical resources to definitely close the ill-fated plant. In short, although various Eastern recipient countries engaged in risky activities, their behavior cannot be characterized as moral hazard.

The extent to which *information and distribution problems* shaped the effectiveness of the examined transactions varied. The effectiveness of the two transactions in which the NSA was the principal donor were unaffected by these two problems. Indeed, negotiations between the NSA and the Bulgarian and Lithuanian governments were concluded rather swiftly, without much haggling over the costs and benefits of cooperation. This outcome had much to do with the fact that it did not make sense for the recipient governments to bargain for extensive compensation because the sources of the NSA were in any case limited. Moreover, the NSA had based its closure deals on rather long-term and vague conditions, thereby allowing the recipient governments to discount future closure costs and granting them sufficient room for maneuver in complying with future closure commitments.

The effectiveness of the three transactions in which the European Commission was the principal donor was also unaffected by information and distribution problems. To be sure, the Commission may have encountered difficulties in determining the applicant countries' "real" preferences, and the three applicant countries did in fact seek to gain the maximum amount of compensation in exchange for the latest possible closure schedules. However, these problems did not seriously delay or prevent the conclusion of closure negotiations. This outcome can be at least partly attributed to the fact that the Commission had set a tight deadline for the establishment of "realistic" closure commitments, thereby limiting the time to haggle over the costs and benefits of cooperation.

In contrast, information and distribution problems did hamper the effectiveness of the transaction between the EBRD and the Slovak Republic. Incomplete information regarding the long-term development of fossil fuel prices and the Slovak Republic's future energy demand as well as widespread doubts about the Slovak government's sincerity to close Bohunice units 1-2 in the near future intensified the controversy surrounding the Western-led Mochovce completion project and thereby hampered the timely conclusion of a closure deal. Moreover, the repeated efforts by the Slovak government to extract more favorable terms from the EBRD—terms that the bank was unwilling or unable to concede—had the effect of protracting negotiations. The effectiveness of the transaction between the G-7/EU and Ukraine was also to a certain extent hampered by information and distribution problems. The difficulties the Western donors encountered in determining how much the closure of the Chernobyl NPP would cost and which specific measures were the most cost-effective to enable and induce the Ukrainian government to comply with Western closure demands led to delays in concluding and implementing the MoU. In addition, both the negotiation and

implementation of the MoU were protracted as a result of the stingy bargaining over the costs and benefits of cooperation. Indeed, it took nearly two years of diplomatic haggling over the amount and type of compensation until the MoU could be finally concluded. And even thereafter, implementation of the MoU stalled as a result of Ukrainian dissatisfaction with the size and composition as well as the slow disbursement of the pledged Western aid.

The occurrence of *enforcement problems* varied across the examined transactions. Enforcement problems played no role in the two transactions between the EBRD and the Slovak Republic and between the G-7/EU and Ukraine, either because the negotiating parties had failed to conclude a closure deal or because the recipient country ultimately did comply with its commitments. In contrast, enforcement problems hampered the effectiveness of those two transactions in which the NSA was the principal donor. In these two transactions the NSA clearly lacked the means to induce the Bulgarian and Lithuanian governments to abide by their commitments. Indeed, once the funds earmarked for the safety upgrade programs at the Kozloduy and Ignalina NPPs had been disbursed, the NSA could no longer threaten to withhold the further disbursement of grant money to ensure that the recipient governments complied with their commitments. In addition, the NSA had no control over the long-term investment activities of the EBRD and the World Bank, both of which proved unwilling to increase the recipient countries' perceived costs of non-compliance with the terms of the NSA grant agreements by threatening to suspend loan financing and assistance programs. This reluctance on the part of IFIs to enforce the NSA's closure agreements was at least in part a result of the widespread perception that the capacities of the Eastern recipient countries to cooperate in the nuclear safety field were constrained and that the imposition of punitive measures such as the suspension of loan financing programs risked not only being ineffective, but possibly even counterproductive.

Enforcement problems also negatively affected the effectiveness of two transactions between the European Commission and the applicant countries, i.e. the Slovak Republic and Bulgaria. On the one hand, the Commission's attempt to enforce these countries' unilateral or international closure commitments by employing a combination of negative and positive incentives was somewhat hampered by the lobbying efforts of the Western European nuclear industry. Indeed, since this domestic producer group was bound to incur considerable costs from the near-term closure of various nuclear reactors in the Eastern applicant countries—for example in the form of fewer subsidies from Western nuclear safety assistance programs and reduced business opportunities—it lobbied the Commission to abandon or at least relax its

early closure policy. On the other hand, the Commission faced growing internal pressure to relax its closure requirements from those EU Member States that for strategic reasons favored a swift eastward enlargement of the EU. Indeed, since the Commission's uncompromising stance on the closure issue risked to protract or even derail the EU accession process, it is plausible to suggest that various EU Member States exerted pressure on the Commission to adopt a more flexible bargaining stance and accept compromises so as to minimize the strategic risks involved in enforcing the applicant countries' closure commitments. In short, the efforts of the Western European nuclear industry and various EU Member States to safeguard their commercial and strategic interests gave rise to enforcement problems that negatively affected the effectiveness of those two transactions designed to secure "realistic" closure commitments from the Slovak Republic and Bulgaria. It should be noted that even though the Commission's attempt to enforce Lithuania's closure commitments posed similar risks to the commercial and strategic interests of the Western European nuclear industry and various EU Member States, the effectiveness of this transaction was not negatively affected by enforcement problems. This finding has much to do with the fact that the Commission did not have much room for maneuver to relax its closure policy vis-à-vis Lithuania. Indeed, the Commission either insisted that the Lithuanian government close the Ignalina NPP in line with its NSA commitments, or it yielded to the Lithuanian government's plans to rechannel the plant's two RBMKs and accepted the long-term operation of the Ignalina NPP. Given the alarming prospects of the latter option, it is plausible to suggest that the Commission faced less internal pressure to relax its closure requirements in this transaction.

The efficiency (second dimension) of most of the examined transactions was seriously affected by the specific *problem-definition* adhered to by the Western donors. Indeed, in all examined transactions apart from the three transactions between the European Commission and the applicant countries, the Western donors adhered to a rather pro-nuclear problem-definition that in effect precluded the employment of potentially more cost-effective funding strategies. This rather pro-nuclear problem-definition was reflected in the specific capacity-building measures the Western donors chose to fund and implement in the various examined transactions: Whereas the main thrust of the Western response to the nuclear safety problem in Bulgaria and Lithuania involved the funding and implementation of near-term safety upgrades at the Kozloduy and Ignalina NPPs, the EBRD was bent on funding the completion of Mochovce units 1-2 in exchange for the premature of Bohunice units 1-2, despite widespread objections that the construction of a new gas-fired power plant would be both

more economical and environmentally safe. Moreover, even though various opportunities existed to address Ukraine's energy problems and hence enable the hard-pressed country to prematurely close the Chernobyl NPP more effectively and at lower cost than completing the Khmelnitsky-2 and Rovno-4 reactors, the major Western donors were reluctant to abandon the K2/R4 project in favor of alternative energy projects and used their influence to ensure that the costly nuclear completion project was tentatively approved for loan financing in December 2000.

The propensity on the part of the Western donors to define the nuclear safety problem in CEE and the FSU in nuclear friendly ways and the resulting pro-nuclear bias in the Western funding strategies were largely determined by the commercial, political and strategic interests of the Western nuclear industry and their governmental supporters. On the one hand, Western nuclear engineering firms had been quick to realize that the nuclear safety problem in CEE and the FSU did not only represent a threat to their commercial survival, but also provided a tremendous commercial opportunity to secure much needed business contracts. As a result, they used their considerable political weight—nuclear utilities and suppliers are generally very large, well-organized, often state-owned, and thus politically influential—to lobby their respective national governments into defining the nuclear safety problem in ways that served their commercial interests, i.e. as a problem that could be solved by technical safety upgrade programs or by the construction of new nuclear power generating capacity. Various Western governments, on the other hand, proved to be susceptible to such lobbying efforts. Indeed, by granting assistance for technical safety upgrades or by providing loans for the completion of partly built nuclear reactors in the East, pro-nuclear Western governments had a politically convenient opportunity to subsidize their own suffering nuclear industries and to help them gain a foothold in the potentially lucrative Eastern nuclear market. In addition, strategic considerations such as the desire of various Western countries to reinforce Ukrainian independence by reducing the country's reliance on Russian fossil fuel imports enhanced the propensity on the part of the Western donors to define the nuclear safety problem in pro-nuclear ways. In short, due to the commercial, political and strategic interests of the influential Western nuclear industry and various pro-nuclear Western governments, the Western donors adopted in all but three examined transactions a problem-definition that in effect thwarted the funding and implementation of more cost-effective capacity-building measures aimed at securing risk-reducing and in particular risk-eliminating behavioral changes on the part of the Eastern recipient countries.

The "*slippery slope effect*" seriously hampered the effectiveness of those two transactions in which the NSA was the principal donor. The empirical analysis of these two transactions has shown that the successful implementation of the NSA-funded safety upgrade programs at the Kozloduy and Ignalina NPPs had the unintentional effect of enhancing both the incentives and capacities of the Bulgarian and Lithuanian governments to keep their high-risk nuclear reactors in operation beyond the scheduled closure dates. Indeed, the externally financed modernization of these units did not only make their long-term operation technically more feasible and economically more profitable, but also allowed the Bulgarian and Lithuanian authorities to argue that the achieved safety improvements had removed all cause for concern about prolonging these units' service lives. The effectiveness of the other examined transactions was unaffected by the "slippery slope effect". Indeed, even if the EBRD's closure deal with the Slovak Republic had materialized, the provision of Western loans for the completion and upgrading of Mochovce units 1-2 could not have had the unintentional effect of enhancing the incentives and/or capacities of the Slovak Republic to continue to engage in undesirable behavior, i.e. to prolong the service lives of Bohunice units 1-2. Similarly, since the aid pledged by the European Commission in exchange for the establishment of "realistic" closure commitments was earmarked for decommissioning activities and was as such inextricably linked to the closure of high-risk nuclear reactors, it did not enhance the incentives and/or capacities of the applicant countries to keep their high-risk nuclear reactors in operation. Finally, even though the Western donors agreed to provide around ECU 13 million for near-term safety upgrades at the third unit of the Chernobyl NPP, the implementation of this specific capacity-building measure did not tempt and/or enable the Ukrainian government to extend the service life of the third unit of the Chernobyl NPP, most likely because the amount of safety-enhancing equipment installed at Chernobyl unit 3 was minimal and did not significantly alleviate the reactor's severe safety deficiencies.

The occurrence of *coordination problems* among the donors and the extent to which these problems negatively affected the effectiveness of the examined transactions varied significantly. The effectiveness of the transaction between the NSA and Bulgaria was to a certain extent hampered by two coordination problems. One coordination problem appears to have occurred between the NSA and the IFIs that were expected to provide loan financing for the so-called "trigger projects", i.e. the various energy investment projects designed to facilitate the premature closure of Kozloduy units 1-4. Not least to secure the repayment of disbursed funds, these IFIs had made the approval of loans for the designated energy projects

contingent on far-reaching market reforms in the Bulgarian energy sector. The Bulgarian government, however, was often unwilling to comply with such loan conditions, which in turn delayed the scheduled implementation of the various "trigger projects". Moreover, the modernization of Kozloduy units 5-6 was delayed due to the reluctance of the EBRD to provide the necessary funds. Hence the failure to secure risk-eliminating behavioral changes on the part of Bulgaria may be partly attributed to the fact that IFIs were entrusted with fulfilling a major part of the conditions stipulated by the NSA agreement, and that these IFIs proved to be reluctant to subordinate their own interests to the NSA goal of securing the premature closure of Kozloduy units 1-4. However, this assessment must be qualified in two respects. First, the implementation of far-reaching and socially painful market reforms was in effect a necessary means to restructure Bulgaria's ailing energy sector and to improve energy efficiency. Second, the Bulgarian authorities proved to be rather uncooperative in loan negotiations with the IFIs.

A further coordination problem took place among those donor countries and firms capable of funding and conducting upgrade work at Kozloduy units 1-4. Indeed, even though these units were scheduled for closure in 1997/1998, the Russian nuclear industry, backed by loans from the Russian government, repeatedly offered to upgrade these units for prolonged operation. These aggressive Russian bids strengthened the Bulgarian government's resolve to prolong the service lives of Kozloduy units 1-4 and prompted Western nuclear firms to consider conducting life-extending modernization work at these units. The effectiveness of the transaction between the NSA and Lithuania, on the other hand, was not negatively affected by coordination problems. The rehabilitation of Lithuania's energy sector was not delayed because IFIs lacked the flexibility and/or willingness to provide funds for this purpose, but rather because Lithuania—facing large surpluses of cheap electricity produced by the Ignalina NPP—had only little incentive to invest scarce resources in a more efficient use and production of power. Moreover, the NSA-led attempt to secure risk-eliminating behavioral changes on the part of the Lithuania was not hampered by offers from Russian or Western nuclear firms to upgrade and prolong the service lives of the two RBMK units.

Coordination problems seriously affected the effectiveness of the attempted transaction between the EBRD and the Slovak Republic. To begin with, the whole controversy surrounding the Western-led Mochovce completion project—which ultimately had the effect of impeding the conclusion of a closure deal—was to a large extent the result of a coordination problem. Indeed, whereas the French and German governments strongly

supported the project not least in order to promote the commercial interests of French and German firms, a vigorous opposition movement spearheaded by the anti-nuclear Austrian government and various Western environmental pressure groups sought to prevent international funding for the project since this would have likely created a precedent for the completion of other partly built Soviet-designed nuclear reactors in CEE and the FSU. Uncoordinated actions by Western nuclear firms also hampered the conclusion of a closure deal. While the EBRD was seeking to make international funding for the Mochovce completion project contingent on a Slovak commitment to prematurely close Bohunice units 1-2, the German firm Siemens signed a $150 million contract to modernize these two unsafe units. Even though Siemens argued that its modernization program did not include life-extension work, in the end it did have the effect of increasing the Slovak government's incentives to keep Bohunice units 1-2 in operation for as long as possible. The most serious coordination problem in this examined transaction took place among those potential donor countries and firms capable of financing and completing Mochovce units 1-2. Indeed, the Czech-Russian counter-offer to complete the Mochovce NPP both at lower costs and without substantial loan conditions such as electricity price increases and the premature closure of Bohunice units 1-2 was probably the most important reason why the EBRD's closure deal failed to materialize.

In contrast, the effectiveness of the examined transactions between the European Commission and the three applicant countries was unaffected by coordination problems. This finding has much to do with the fact that the Commission was authorized to negotiate over closure commitments on behalf of all EU Member States, which in turn prevented both burden-sharing problems and the pursuit of conflicting national strategies aimed at securing "realistic" closure commitments from the applicant countries.

Finally, coordination problems also hampered to a certain extent the effectiveness of the transaction between the G-7/EU and Ukraine. After much debate over how to compensate Ukraine for the closure of the Chernobyl NPP, the G-7 and the European Commission resolved in late 1995 to fund the completion of the two partly built Khmelnitsky-2 and Rovno-4 reactors as the principal Chernobyl power replacement project. Following the inclusion of this investment target in the MoU, the G-7 countries had instructed the EBRD to assume the leading role in financing the K2/R4 project. However, the EBRD subsequently proved both unable and unwilling to promptly comply with this request, in particular after the independent panel had concluded in early 1997 that the plan to complete these two nuclear

reactors did not represent the most cost-effective use of Western funds. Since the resulting impasse over loan financing for the K2/R4 project did not only jeopardize the successful implementation of the MoU, but also threatened the strategic and commercial interests of various Western donor states and their nuclear industries, the leading Western donor states prevailed upon the EBRD to commission a second external review of the project's cost-effectiveness. Although the somewhat more positive conclusions of the second external review, combined with the ongoing political pressure from the major Western donor states, saved the K2/R4 project from certain demise, the EBRD continued to doubt the project's financial viability and remained rather reluctant to shoulder the considerable financial risk. As a result, the EBRD did not only insist on increasingly stringent loan conditions, but also repeatedly delayed its final decision on loan financing for the project. The provision of loans for the K2/R4 project was further delayed due to a widening fissure among the major Western donor states. Indeed, just as the loan financing process had been gaining momentum, the Bundestag voted against German participation in the funding of the K2/R4 project and called on the German government to support non-nuclear options in Ukraine instead. In short, coordination problems among the Western donors seriously delayed the provision of loans for the K2/R4 project. These repeated delays, in turn, hampered the effectiveness of the transaction by prompting the Ukrainian government to keep the remaining operational unit of the Chernobyl NPP in operation as long as possible.

The following table summarizes the results of the empirical analysis and depicts in which transaction which problems hypothetically associated with designing and implementing positive incentives had an influence on the outcomes to be explained.

TABLE 9.2: SYNOPSIS OF PROBLEMS AFFECTING THE EFFECTIVENESS AND/OR EFFICIENCY OF THE EXAMINED TRANSACTIONS

Case Studies Donor — Recipient	**Effectiveness**	**Efficiency (first dimension)**	**Efficiency (second dimension)**	Extortion	Moral Hazard	Information Problems	Distribution Problems	Enforcement Problems	"Slippery Slope Effect"	Problem-Definition	Coordination Problems among Donors
Case Study I NSA — Bulgaria	**Rather Low**	**High**	**Rather Low**								
Case Study II NSA — Lithuania	**Rather Low**	**High**	**Rather Low**								
Case Study III EBRD — Slovak Republic	**Low**	**High**	**Rather Low**								
Case Study IV											
European Commission — Slovak Republic	**Rather High**	**High**	**High**								
European Commission — Lithuania	**High**	**High**	**High**								
European Commission — Bulgaria	**Rather High**	**High**	**High**								
Case Study V G-7/EU — Ukraine	**Rather High**	**High**	**Rather Low**								

Note: Shade of the squares depicts the degree to which the respective problems influenced the outcomes to be explained (bright shade = slight influence; dark shade = large influence).

The empirical analysis of the various transactions that materialized in the nuclear safety field suggests that the employment of positive incentives can be an effective and efficient policy tool to foster international environmental cooperation. To begin with, in four examined transactions the employment of positive incentives was rather effective in driving the behavior of the recipient in a direction desired by the donors. In addition, I did not find any outright failures in the sense that when positive incentives were provided they did not have any impact on recipient behavior. Finally, all examined transactions were efficient in the sense that the donors could not have secured comparable or superior behavioral changes on the part of the recipient countries at a lower or comparable cost by employing other cooperation strategies (first dimension of efficiency). This finding has much to do with the fact that under conditions of strong asymmetric preferences and capacities, the employment of positive incentives is often the only practical cooperation strategy.

In addition, the efficiency of the examined transactions was not negatively affected by extortion or moral hazard problems. Indeed, although various recipient countries threatened to adopt risk-enhancing behaviors if not compensated for refraining from doing so, their

behavior did not amount to extortion because they would have likely delivered on their threats if compensation had not been provided. In this respect it is important to note that the recipient countries' willingness to engage in risk-enhancing behaviors—even if such behaviors were not in their genuine interest—was strongly determined by their insufficient capacities to adopt desirable, risk-eliminating behaviors in the absence of external compensation. Similar conclusions can be drawn with respect to the occurrence of moral hazard problems: Even though some recipient countries engaged in risky activities, the rationale behind such action was not the expectation of thereby enticing the donors to provide the necessary assistance to reduce the risks of their behaviors to an acceptable level. Indeed, if the recipient countries had any ulterior motive to engage in risky activities, it related to the expectation of thereby enticing the donors to provide the necessary assistance so as to enhance their capacities to adopt desirable, risk-eliminating behaviors. It hence appears that the risk of extortion and moral hazard problems hampering the efficiency of transactions is rather low, at least in situations involving strong asymmetric capacities.

On the other hand, this rather optimistic assessment of the potential of positive incentives in fostering international environmental cooperation must be qualified in various respects. To begin with, positive incentives proved to be most effective in enticing recipient cooperation when employed in combination with other cooperation strategies, in particular with negative incentives. In this respect, the possibility of the European Commission to link the EU membership prospects of the three applicant countries to a cooperative stance on the closure issue proved to be a window of opportunity that was not available in the other examined transactions.

Second, it cannot be denied that the effectiveness of the examined transactions varied significantly, and that all but one of the seven examined transactions failed to be fully effective. As discussed above, the varying degrees of ineffectiveness in the seven examined transactions can be attributed to a host of theoretically predicted problems in designing and implementing positive incentives, i.e. in particular to cooperation problems and the "slippery slope effect", and to a lesser extent to enforcement, information and distribution problems. It should be further noted that depending on the circumstances there might be no adequate strategies that the donors can pursue to alleviate or overcome these problems. For example, a promising strategy to minimize cooperation problems is to pool the resources of the various donors under the custody of an international funding agency. Yet it may prove difficult or impossible to bind all potential donors into such a united donor front, in particular if

considerable private benefits can be gained from uncoordinated actions. And even if a united donor front can be established, coordination problems are likely to resurface when there are many donors and/or many possible investment targets. Or to avoid another problem that seriously affected the effectiveness of the examined transactions, i.e. the "slippery slope effect", the donors have to ensure that resource transfers aimed at enhancing the recipient's capacities to adopt a desirable behavior are contingent upon the recipient both adopting such desirable behavior and refraining from engaging in a undesirable behavior. Yet if this is not feasible, which might often be the case in international environmental affairs, the only strategy that the donors can pursue to avoid the "slippery slope effect" is to refrain from funding certain capacity-building measures. The drawback of such a strategy is that the donors may have to endure continued or higher levels of environmental risk in the near- to mid-term, which might not be possible for domestic political reasons.

Third, it is important to note that the efficiency (first dimension) of positive incentives might not be so high under different circumstances. Indeed, in externality situations involving less pronounced asymmetric preferences and capacities, the employment of other cooperation strategies might be a more cost-effective response to transnational environmental problems.

Finally, it must be emphasized that all but three of the examined transactions involved potentially serious inefficiencies in the sense that the Western donors could have possibly secured comparable or superior behavioral changes on the part of the Eastern recipient countries at a lower or comparable cost by employing positive incentives in different ways. The most important problem that shaped the efficiency (second dimension) of the examined transactions relates to how the donors defined the environmental problem at hand, or in other words to the specific problem-definition adhered to by the donors. Indeed, in most examined transactions the Western donors adopted a rather one-sided problem-definition that was closely geared to the commercial interests of their domestic nuclear industries and to their own political and strategic interests. This specific problem-definition resulted in a rather strong pro-nuclear bias in the Western donors' funding strategy that ultimately precluded the funding and implementation of other, potentially more cost-effective capacity-building measures designed to solve the nuclear safety problem in CEE and the FSU. In this respect it is important to note that it may be difficult to avert the potential inefficiencies inherent to the way donors define an environmental problem since there appears to be a trade-off between the effectiveness of a transaction in terms of the amount of resources the donors are willing to allocate and the efficiency of a transaction in terms of the specific problem-definition adhered

to by the donors. Indeed, the prospect of securing commercial benefits for their domestic industries and promoting other political and strategic interests is often an important reason why donors are willing to provide a substantial amount of resources for international environmental assistance programs and to engage in transactions, in particular then when they are not strongly or directly exposed to transboundary environmental pollution or risks. But a one-sided problem-definition and policy implementation may involve serious efficiency problems.

Thus with a view to the caveats outlined above, a more cautious conclusion regarding the role of positive incentives in international environmental politics is warranted: While positive incentives can indeed contribute significantly to driving the behavior of recipient countries in a direction desired by provider countries, they are not a panacea for solving transnational environmental problems in effective and efficient ways. In social science terminology, positive incentives are often a necessary, but not always a sufficient condition for fostering successful international environmental cooperation.

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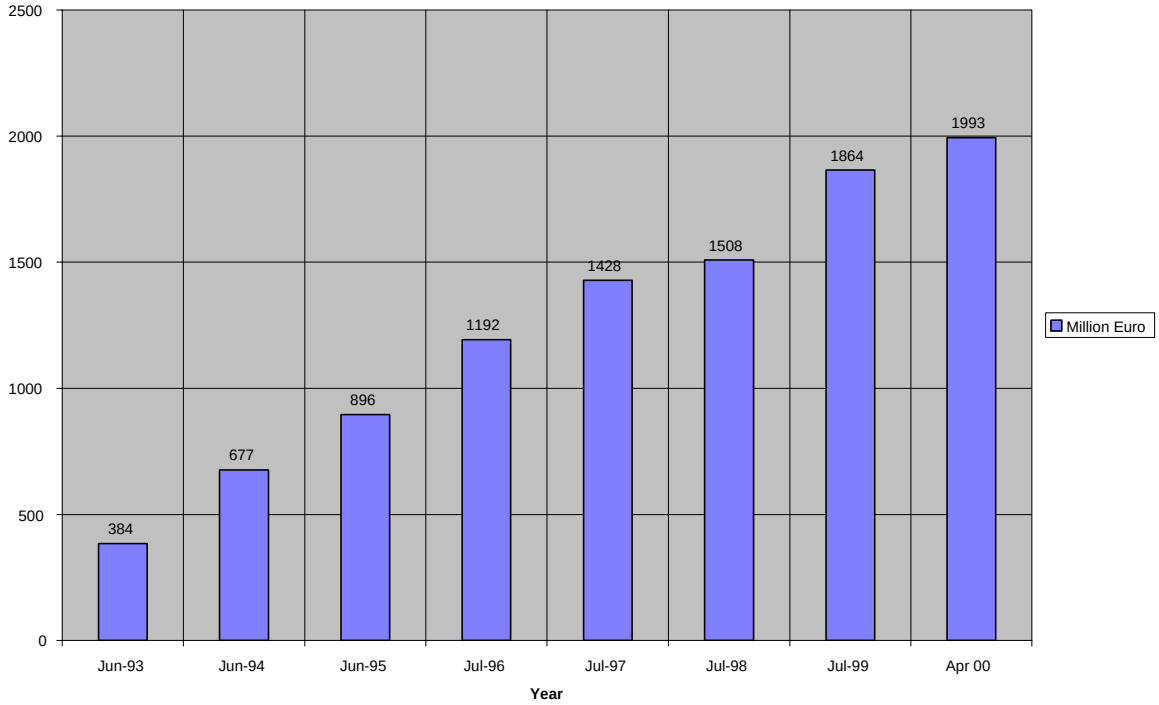
11 APPENDIX

TABLE 11.1: NATIONAL DEPENDENCE ON NUCLEAR POWER (1992-1995)

Country	**Nuclear Contribution to Total Electricity, in Percent**				**Total Nuclear TWh Generated in 1995**
	1992	**1993**	**1994**	**1995**	
Lithuania	60.0	87.2	76.4	85.6	10.6
France	72.9	77.7	75.3	76.1	358.6
Belgium	59.9	58.9	55.8	55.5	39.2
Sweden	43.2	42.0	51.1	46.6	66.7
Bulgaria	32.5	36.9	45.6	46.4	17.3
Slovak Republic	49.5	53.6	49.1	44.1	11.4
Hungary	46.4	43.3	43.7	42.3	13.2
Switzerland	39.6	37.9	36.8	39.9	23.5
Slovenia	34.6	43.3	38.0	39.5	4.6
Ukraine	25.0	32.9	34.2	37.8	65.6
South Korea	43.2	40.3	35.5	36.1	63.7
Spain	36.4	36.0	35.0	34.1	53.1
Japan	27.7	30.9	30.7	33.4	286.9
Finland	33.2	32.4	29.5	29.9	18.1
Germany	30.1	29.7	29.3	29.1	154.1
Taiwan	35.4	33.5	31.7	28.8	33.9
United Kingdom	23.2	26.3	25.8	25.0	77.6
United States	22.3	21.2	22.0	22.5	673.4
Czech Republic	20.7	29.2	28.2	20.1	12.2
Canada	15.2	17.3	19.1	17.3	92.3
Argentina	19.2	14.2	13.8	11.8	7.1
Russian Federation	11.8	12.5	11.4	11.8	99.4
South Africa	6.0	4.5	5.7	6.5	11.3
Mexico	3.2	3.0	3.2	6.0	8.4
Netherlands	4.9	5.1	4.9	4.9	3.7
India	3.3	1.9	1.4	1.9	6.5
China	0.1	0.3	1.5	1.2	12.4
Brazil	0.7	0.2	0.01	1.0	2.5
Pakistan	1.2	0.9	1.0	0.9	0.5
Kazakhstan	0.6	0.5	0.6	0.1	0.1

Source: NN, June 1995: 48; NN, June 1996: 36.

FIGURE 11.1: HISTORICAL DEVELOPMENT OF DONOR CONTRIBUTIONS (NUCLEAR SAFETY ASSISTANCE REPORTED TO NUSAC)



Note: The donor contribution amounts in this table are lower limits since some donor contributions have not yet been reported to NUSAC. Source: G-24 NUSAC Database, April 2000.

TABLE 11.2: DONORS INVOLVEMENT

Donor	**Contribution (in Million Euro)**	**Percentage of Total Contributions**
EC	754.23	37.8
Belgium	6.01	0.3
Denmark	4.03	0.2
France	87.74	4.4
Germany	181.51	9.1
Italy	23.63	1.2
Netherlands	4.74	0.2
Spain	2.87	0.1
United Kingdom	48.13	2.4
Austria	0.10	0.0
Finland	17.50	0.9
Norway	16.37	0.8
Sweden	45.05	2.3
Switzerland	12.68	0.6
Canada	26.73	1.3
Japan	145.01	7.3
United States	569.21	28.6
EBRD	0.58	0.0
World Bank	0.51	0.0
OECD	0.38	0.0
IAEA	45.73	2.3
Total	1'992.75	100

Note: Contributions to the NSA have been allocated to the individual donors. Source: G-24 NUSAC Database, April 2000.

TABLE 11.3: RECIPIENTS INVOLVEMENT

Recipient	**Million Euro**	**Percentage of Total**
Bulgaria	133.18	6.7
Slovak Republic	57.50	2.9
Czech Republic	51.89	2.6
Other CEE Countries	62.00	3.1
Regional (CEE)/Unspecified	56.86	2.9
Russian Federation	744.18	37.3
Ukraine	659.69	33.1
Lithuania	132.54	6.7
Other FSU Countries	69.36	3.6
Regional (FSU)	25.55	1.3
Total	1’992.75	100

Source: G-24 NUSAC Database, April 2000.

TABLE 11.4: OVERVIEW OF DONOR CONTRIBUTIONS AND PROJECT STATUS FOR G-7 TECHNICAL AREAS

Technical Area	Project Completed	Project Underway	Financing Decision Taken	**Sub-Total**	Firm Commitment	Interest, Proposals	**Total**
Operational Safety Improvement	207.0 (10.4%)	473.5 (23.8%)	34.2 (1.7%)	**714.7** (35.9%)	0.0 (0.0%)	32.3 (1.6%)	**747.0** (37.5%)
Near-Term Safety Improvement of NPPs	124.9 (6.3%)	329.5 (16.5%)	30.8 (1.5%)	**485.1** (24.3%)	0.0 (0.0%)	5.5 (0.3%)	**490.6** (24.6%)
Enhancing Regulatory Regimes	111.3 (5.6%)	148.6 (7.5%)	53.2 (2.7%)	**313.1** (15.7%)	0.0 (0.0%)	3.2 (0.2%)	**316.4** (15.9%)
G-7 Near-Term Action Programme Sub-Totals	**443.2** (22.2%)	**951.6** (47.8%)	**118.2** (5.9%)	**1'513.0** (75.9%)	**0.0** (0.0%)	**41.0** (2.1%)	**1'554.0** (78.0%)
Energy Strategy Studies	5.2 (0.3%)	4.4 (0.2%)	0.0 (0.0%)	**9.6** (0.5%)	0.0 (0.0%)	0.0 (0.0%)	**9.6** (0.5%)
Long-Term Upgrading of NPPs	44.7 (2.2%)	22.8 (1.1%)	13.1 (0.7%)	**80.6** (4.0%)	0.0 (0.0%)	0.0 (0.0%)	**80.6** (4.0%)
G-7 Overall Programme Sub-Totals	**493.2** (24.7%)	**978.8** (49.1%)	**131.2** (6.6%)	**1'603.2** (80.5%)	**0.0** (0.0%)	**41.0** (2.1%)	**1'644.3** (82.5%)
Radiation Protection	23.0 (1.2%)	38.8 (1.9%)	7.3 (0.4%)	**69.0** (3.5%)	0.0 (0.0%)	3.1 (0.2%)	**72.1** (3.6%)
Fuel Cycle and Radwaste Projects	21.4 (1.1%)	96.4 (4.8%)	14.5 (0.7%)	**132.2** (6.6%)	0.0 (0.0%)	2.3 (0.1%)	**134.6** (6.8%)
Other	34.4 (1.7%)	93.6 (4.7%)	12.0 (0.6%)	**139.9** (7.0%)	0.0 (0.0%)	1.9 (0.1%)	**141.8** (7.1%)
Grand Totals	**571.9** (28.7%)	**1'207.6** (60.6%)	**164.9** (8.3%)	**1'944.4** (97.6%)	**0.0** (0.0%)	**48.3** (2.4%)	**1'992.7** (100.0%)

Note: The financial contribution for projects concerning more than one area has been equally divided, unless specific information was provided on the actual allocation. The amounts in this table are lower limits since some donor contributions have not yet been reported to NUSAC. Contributions in Mio Euro. Source: G-24 NUSAC Database, April 2000.

TABLE 11.5: INSTALLATION TYPE—PROJECT STATUS OVERVIEW FOR ALL PROJECTS HELD IN THE NUSAC DATABASE

Installation Type	Project Completed	Project Underway	Financing Decision Taken	**Sub-Total**	Firm Commitment	Interest, Proposal	**Total**
VVER-440/230	111.6 (5.6%)	130.5 (6.5%)	13.1 (0.7%)	**255.2** (12.8%)	0.0 (0.0%)	4.0 (0.2%)	**259.2** (13.0%)
VVER-440/213	52.0 (2.6%)	80.7 (4.0%)	22.7 (1.1%)	**155.4** (7.8%)	0.0 (0.0%)	4.1 (0.2%)	**159.4** (8.0%)
VVER-1000	117.0 (5.9%)	259.9 (13.0%)	40.7 (2.0%)	**417.6** (21.0%)	0.0 (0.0%)	17.0 (0.9%)	**434.6** (21.8%)
VVER (All)	33.1 (1.7%)	49.4 (2.5%)	8.1 (0.4%)	**90.6** (4.5%)	0.0 (0.0%)	0.0 (0.0%)	**90.6** (4.5%)
RBMK-1000	49.8 (2.5%)	230.3 (11.6%)	23.9 (1.2%)	**304.0** (15.3%)	0.0 (0.0%)	7.1 (0.4%)	**311.1** (15.6%)
RBMK-1500	36.8 (1.8%)	62.4 (3.1%)	1.8 (0.1%)	**101.0** (5.1%)	0.0 (0.0%)	3.1 (0.2%)	**104.1** (5.2%)
RBMK (All)	26.3 (1.3%)	44.5 (2.2%)	6.3 (0.3%)	**77.2** (3.9%)	0.0 (0.0%)	3.6 (0.2%)	**80.8** (4.1%)
BN (Fast Reactor)	10.7 (0.5%)	9.0 (0.5%)	3.0 (0.2%)	**22.8** (1.1%)	0.0 (0.0%)	2.9 (0.1%)	**25.7** (1.3%)
PHWR	2.6 (0.1%)	1.6 (0.1%)	1.0 (0.0%)	**5.1** (0.3%)	0.0 (0.0%)	0.0 (0.0%)	**5.1** (0.3%)
All Types of NPP	58.5 (2.9%)	129.4 (6.5%)	10.7 (0.5%)	**198.7** (10.0%)	0.0 (0.0%)	0.3 (0.0%)	**199.0** (10.0%)
Research Reactor	1.5 (0.1%)	2.3 (0.1%)	0.2 (0.0%)	**4.0** (0.2%)	0.0 (0.0%)	0.0 (0.0%)	**4.0** (0.2%)
Enrichment Plant	0.1 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	**0.1** (0.0%)	0.0 (0.0%)	0.0 (0.0%)	**0.1** (0.0%)
Reprocessing Plant	0.5 (0.0%)	0.3 (0.0%)	0.0 (0.0%)	**0.7** (0.0%)	0.0 (0.0%)	0.0 (0.0%)	**0.7** (0.0%)
Fuel Storage	2.7 (0.1%)	31.8 (1.6%)	0.5 (0.0%)	**35.0** (1.8%)	0.0 (0.0%)	0.3 (0.0%)	**35.3** (1.8%)
Radwaste Storage	6.4 (0.3%)	48.2 (2.4%)	8.5 (0.4%)	**63.1** (3.2%)	0.0 (0.0%)	1.0 (0.1%)	**64.2** (3.2%)
Other Installation	7.7 (0.4%)	58.5 (2.9%)	8.2 (0.4%)	**74.4** (3.7%)	0.0 (0.0%)	1.4 (0.1%)	**75.8** (3.8%)
All Installations	39.2 (2.0%)	44.5 (2.2%)	15.4 (0.8%)	**99.1** (5.0%)	0.0 (0.0%)	3.4 (0.2%)	**102.4** (5.1%)
Unknown or Not Specified	15.5 (0.8%)	24.2 (1.2%)	0.9 (0.0%)	**40.5** (2.0%)	0.0 (0.0%)	0.0 (0.0%)	**40.5** (2.0%)
Total	571.9 (28.7%)	1’207.6 (60.6%)	164.9 (8.3%)	**1’944.4** (97.6%)	0.0 (0.0%)	48.3 (2.4%)	**1’992.7** (100.0%)

Note: The financial contribution for projects addressing more than one installation type has been equally divided over all installation types. Contributions in Mio Euro. Source: G-24 NUSAC Database, April 2000.

TABLE 11.6: APPROVED INTERNATIONAL FINANCING FOR ENERGY PROJECTS IN UKRAINE (1995-2000)

Lender	Loan (in $ mio.)	Project Description	Approval Date
World Bank	**114**	**Hydropower Rehabilitation and System Control Project** The project aims to improve the quality of electricity supply by rehabilitating hydropower plants and improving power system control.	**April 1995**
World Bank	**317**	**Electricity Market Development Project*** The project supports the development of a competitive electricity market in Ukraine by: 1) building up stocks of fuel and spare parts and providing overdue maintenance at 14 thermal power plants, 2) installing metering and communications equipment to improve recording and billing of electricity use and 3) providing technical services and training for implementing the project, managing the finances, and developing a privatization program. *The World Bank cancelled this loan in mid-1999 (PEE, 25 June 1999: 14).	**October 1996**
Germany	**80**	**Chernobyl Replacement Project** This project, which is being supported by the German government in the form of federal export insurance, will upgrade unit 8 of the Smijev coal-fired power plant. This pilot project will help to replace Chernobyl power by improving the capacity of the Smijev station from 270 MW to 325 MW.	**October 1996**
EBRD	**113**	**Starobeshovo Power Plant Modernization** Defined as a priority investment to advance the restructuring of Ukraine's energy sector and the ultimate closure of the Chernobyl NPP, the loan will finance the replacement of an old coal-fired boiler with a more efficient and less polluting 210 MW unit. The project will contribute to a significant improvement in energy efficiency, as the new boiler will use a waste product, replacing expensive local coal and imported gas and fuel oil.	**December 1996**
EBRD	**30**	**Ukrainian Energy Service Company** The loan will be used to identify and implement energy-saving investments in small and medium-sized enterprises and public sector institutions and to encourage the development of broader energy saving activities in Ukraine	**May 1998**
World Bank	**200**	**Heat Supply and Energy Efficiency Project** The objectives of this project are threefold: 1) extend the life of, increase the efficiency of, enhance conservation of, and improve the reliability and service levels in heating systems in Kiev and Sevastopol through rehabilitation work; 2) improve the energy efficiency of public buildings and reduce heat demand and thus the need for expansion of heat production capacity in Kiev; and 3) support the commercialization and development of District Heating companies.	**May 1998**
World Bank	**18**	**Kiev Public Buildings Energy Efficiency Project** This project is designed to help implement the Ukrainian Government's Comprehensive State Energy Conservation Program, which aims at achieving annual savings, by the year 2010, in coal equivalency, or a third of the total energy consumption in Ukraine, through targeted investments. The components call for: 1) energy efficiency improvements in institutional buildings, 2) technical audits, to yield engineering estimates of the buildings' present energy consumption, and provide feasible retrofit actions for energy efficiency, 3) consulting services for project management, and 4) financial audits, to cover incremental audit costs.	**January 2000**
EBRD	**100**	**Ukraine Fuel Purchase Loan** This loan is designed to enable Ukraine to purchase additional supplies of oil and gas following the closure of the Chernobyl NPP.	**October 2000**

Source: Project Descriptions at the Websites of the EBRD and the World Bank; SVA-Bulletin, no. 16, 1996: 8.

Curriculum Vitae

Roy Suter was born on 15 February 1972 in Woodland, California (USA). He went to elementary and secondary school in Davis, California (USA) and in Wettswil/Bonstetten (Switzerland) and graduated from High School in Zürich (Wirtschaftsgymnasium Zürich-Enge) in 1990.

In the fall of 1992 Roy Suter enrolled at the Faculty of Arts of the University of Zürich in History, International Relations (Political Sciences) and English Literature and received a Masters Degree (Lizentiat) in late 1998. Between 1995 and 2000 he worked as a research and teaching assistant at the Center for International Studies (CIS) of the Swiss Federal Institute of Technology in Zürich.

Roy Suter submitted his doctoral thesis in International Relations in October 2000. Between October 2000 and October 2001 he completed a Masters Degree course in International Economic and Business Law (LLM) at the Kyushu University, Fukuoka (Japan). He is currently working and living in Zurich.